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# Car Sharing in Rome: a Case Study to Support Sustainable Mobility

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**Abstract**

Although a "niche" measure, Car Sharing (CS) in Rome proved to be popular and worthy of a city-wide upscale. This prompted the municipality to develop an expansion plan. The authors, responsible for this plan, had to appraise whether CS could be successfully transferred to other locations and assess the environmental benefits thus far achieved as a way to increase CS attractiveness. The paper describes the methodology used and the main results i.e., the operational thresholds and the quality of the built environment required to start operating the service successfully in new districts of the city, along with the benefits for the community, especially under the environmental point of view.



*Keywords:* Car Sharing; Built Environment; Rome; Walking; Accessibility.

## 1. Introduction

Car Sharing (CS) in Rome was launched in March 2005 within a project funded by the European Commission; despite its initial modest implementation, the measure soon proved to be popular and therefore worthy of progressive expansion across the city. CS is currently available in the central areas of the city, but more vehicles are soon expected to be operative in the suburban ones, thanks to the cooperation between the municipal CS operator, Agenzia della Mobilità, and the "Sapienza" University of Rome, which developed an expansion plan for the service.

The need to support CS in Rome is not a minor one. For a decade, the municipality has been promoting a more sustainable mobility policy, as Rome is a city with one of the highest motorization rates in Europe (in 2009: 978 vehicles, including two-wheelers, every 1,000 inhabitants), where transit is

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unable to meet citizens' needs satisfactorily (27% in the modal share vs. 52% by private cars). This has resulted in major impacts on air quality and livability, particularly in the city center, where pollution jeopardizes citizens' health as well as the conservation of historical landmarks and the city's appearance.

Consequently, the CS expansion plan had to address two main issues: first, it had to provide performance values which could constitute a threshold for the feasibility of the service in the new areas; secondly, it had to prove how a "niche" measure, like sharing cars, could help to improve air quality levels and livability. If the former goal is aimed at providing the CS operator with sound reasons, beyond that of sustainability, to expand operations, the latter is focused on increasing the awareness, among traditional drivers, of the need to switch towards more sustainable mobility patterns.

## 2. The CS service

CS operations in Rome during the last six years have improved so as to now have a service available in four central districts, with a potential amount of users equal to about 13% of the urban population, which will potentially increase up to 35% when it becomes operational in the new areas. After an initial one-year trial, from March 2006 to October 2009 the initial five vehicles-fleet increased (35 units), and locations slowly spread (expansion from 22 to 35 in October 2009). In November 2009, the CS operator decided to nearly double the number of locations (from 35 to 61) to accommodate 41 new vehicles, which after two months became 51, in order to integrate the existing 60 vehicles fleet.

The expansion plan aims to add 72 vehicles to the current fleet in 36 new locations, according to a preliminary selection of sites, in four different districts. In spite of such an increase and coherent with its "niche" status, the service supplies a restricted number of members (2,041 in May 2011) with a fleet of 111 vehicles, all of the same make but of different models (varying from subcompact to sedan to minivan). Vehicles are parked on the street and available 24/7 via phone or web reservation.

Although the service can be defined as basic if compared to others abroad (no one-way option, no trendy fleet, no instant access or open-ended reservations or other state-of-the-art ITS), two features make it appealing: circulation bonuses (no parking fees; free travel in taxi/bus lanes; free access to the city Limited Traffic Zones (LTZ)) and affordability (low rates: on average 1.80 Euros per hour plus 0.30 Euros per km; small annual membership fees: 100 Euros; special discounts for transit pass-holders; no extra charges for gas).

## 3. Upscaling operations: methodology and analyses

Even though CS is a recognized self-standing paratransit option, with many successful and profitable examples worldwide (Shaheen and Cohen 2007, MOMO 2011), in Rome the situation is unique, as CS belongs to a larger push-and-pull group of measures, supported by strong political entities and economic efforts, especially targeted to reduce excessive car use. When environmental priorities called for increased action and, at the same time, awareness of CS and its attractiveness spread, the municipality thought to expand it citywide, although the above-mentioned facts stressed its "niche" status.

### *3.1. The methodology*

Upscaling operations required, then, a study phase to assess CS feasibility and to evaluate the likelihood of realizing the environmental goal of reducing traffic-related pollution. The feasibility task started with a preliminary performance analysis of the operation to date, whose findings suggested that the service performance was affected by the quality of the CS parking areas' built environments (in line with what stated in Stillwater, Mokhtarian, and Shaheen 2009). The role played by the built environment became even clearer when the performance analysis was revised, taking into account first the land use features and the quality of the physical environment surrounding each CS parking area (location analysis) and then the CS members' recurring preferences for some areas, mainly linked to the opportunity to walk (CS members' profile). Conventional transit performance indicators were inadequate to assess its expansion, and new parameters were needed to describe how the built environment can affect a given CS location. This prompted the need for assessment accessibility indicators linked to walkability, typically used for other transit options, and to adapt them to the Rome situation. The possibility to broaden the service was then based on fulfilment of both operational and accessibility requirements.

The second task in assessing the CS environmental benefits initially focused on the estimated reduction of pollutant emissions (air quality improvement), but as the role of the built environment became more and more important, it was decided to study the CS potential to increase livability.

### *3.2. The performance analysis*

Studying the overall development of the service during recent years and singling out peculiarities due to such variables as locations, time slots, and use patterns, called for the collection of performance indicators to describe operations' progress; such a performance analysis was developed comparing five different "snapshots" of the service (Table 1): an early stage (January - March 2008 Scenario) when just 22 locations were operational; three intermediate stages (November 2008 - January 2009, November 2009 - January 2010 and March – May 2010 Scenarios) which describe the progressive implementation of the service; and the consolidated contemporary situation (March – May 2011 Scenario).

Operations increased during the first two scenarios while a kind of stabilization occurred in the November 2009 – January 2010 period and partly in the March - May 2010 one, due to the introduction of new vehicles and, above all, new locations in areas where no service was previously available. Once the "novelty" period had passed, the service progressed as before and even escalated until the consolidated scenario (March – May 2011).

Table 1. Development of the CS service in Rome (January 2008 - May 2011; source: Agenzia della Mobilità database)

| Indicators (monthly average values) | Scenarios | | | | |
|---|---|---|---|---|---|
| | Jan - Mar 2008 | Nov 2008 - Jan 2009 | Nov 2009 -Jan 2010 | Mar - May 2010 | Mar - May 2011 |
| Registered members (units) | 783 | 1,040 | 1,371 | 1,536 | 2,041 |
| Actual members (units) | 392 | 452 | 592* 674** | 760** | 642** |
| Vehicles (units) | 35 | 41 | 106 | 106 | 106 |
| Locations (units) | 22 | 25 | 61 | 61 | 61 |
| Total lease (units) | 816* | 1,029* | 1,083* 1,615** | 2,286** | 3,346** |
| Total mileage (km) | 35.97* | 41.81* | 33.46* 53.27** | 80.97** | 116.46** |
| Total usage (hours) | 4,200* | 5,286* | 5,840* 9,175** | 12,090** | 19,647** |
| Local lease (units per location) | 37* | 44* | 49* 27** | 37** | 55** |
| Local mileage (travelled km per location) | 1,599* | 1,900* | 1,521* 873** | 1,326** | 1,909** |
| Local usage (lease hours per location) | 191* | 240* | 265* 150** | 198** | 322** |
| Lease period (hours per lease) | 5.1* | 5.1* | 5.3 * 5.6** | 5.3** | 5.8** |
| Lease mileage (travelled km per lease) | 43.1* | 40.6* | 30.9* 32.9** | 35.4** | 34.8** |
| Member lease (leases per member) | 2.1* | 2.3* | 1.82* 2.4** | 3** | 5.2** |
| Member mileage (travelled km per member) | 89.6* | 92.3* | 56.6* 79** | 105** | 182** |

** 22 locations ** 61 locations*

### 3.3. Location analysis

When observing the above-mentioned data per single location and relating them to the features of the districts they belong to, differences arise, and to study how CS operations may vary by location, more indicators have been calculated (Table 2).

Table 2. CS locations indicators (January 2008 - May 2011)

| Indicators (monthly average values) | | District 1 | District 2 | District 3 | District 17 | Rome |
|---|---|---|---|---|---|---|
| Inhabitants (units) | | 126,861 | 122,971 | 53,059 | 70,068 | 2,800,000 |
| District area (sqkm) | | 14.30 | 13.67 | 5.91 | 5.60 | 1284.8 |
| Population density (inh/sqkm) | | 8,871 | 8,996 | 8,978 | 12,512 | 2,180 |
| Local Modal Split | pedestrians | 8.7 | 6.9 | 11.8 | 6.7 | 5.6 |
| | transit: | 26.1 | 10.3 | 29.4 | 40.0 | 27.0 |
| | private cars | 30.4 | 51.7 | 47.1 | 46.7 | 52.1 |
| | powered two-wheelers: | 34.8 | 31.0 | 11.8 | 6.7 | 15.3 |
| Green areas (% of the whole district area) | | 6.8 | 22.1 | 3.8 | 1.0 | 4.15 |
| Pedestrian areas (% of the whole district area) | | 2.1 | 0.01 | 0 | 0.12 | 0.12 |
| On-street parking areas (% of the whole district area) | | 1.1 | 0.6 | 0.3 | 0.06 | 0.29 |
| LTZs (% of the whole district area) | | 41.9 | 6.0 | 4.4 | 0 | 2.1 |
| CS membership, as CS members resident per district (units) | | 234 | 157 | 95 | 109 | 595 |
| Locations (units) | | 22 | 16 | 13 | 9 | 60** |
| Parking density (Locations/ district area) | | 1.54 | 1.17 | 2.20 | 1.6 | 1.52 |
| CS availability [(members/inhabitants)*1000] | | 1.80 | 1.28 | 1.79 | 1.55 | 1. |
| District coverage (Locations *Influence Area/District Area) | | 0.8 | 0.6 | 1.1 | 0.8 | 0.8 |

**influence area: circumference with radius = 500 m* *** Parking nr. 61 is located in the XI District, available for special uses*

The four districts where CS is available are peculiar: the First District covers most of the city historic center, a compact setting and a built environment of premium value, with mixed land use. Due to poor air quality and traffic congestion, a LTZ has been enforced since the 1990s. In the other three districts, i.e. the Second, Third and 17th Districts, typical Roman medium-to-high income, high density areas built from the 1920s to the 1960s, residential and business activities prevail, even though an area in the Third (where two CS parking lots are located) is a very popular youth “hang-out” and, hence, ruled by a night-time LTZ; daytime access restriction is also applied to the city main park area in the Second District. The quality of the built environment is also high in these districts, with low-rise buildings, plenty of vegetation, full provision of sidewalks, which make them ideal for walking (the walking share in each district in the local modal split is higher than the Rome average).

All of these aspects called for an analysis of the land use characteristics around each location, in order to find relationships between each and with surrounding environments. A qualitative survey was conducted, taking into account, for each location, two main parameters: a) proximity to other CS locations, as well as to metro stations and bus stops, important commercial/business/health care facilities, etc. and b) land use. Results showed that the most preferred locations seem to be those which are very close to transit (up to 200 m bus stops or metro stations; in the case of bus, those with more than three different routes available) and in areas with mixed local land use (mainly commercial and residential); on the contrary, locations close to single commercial or business premises (even though of city importance), in monofunctional areas, or close to the district limits tend to be neglected.

It is worth noting that even though the positive relationship between transit and CS is well-known in scientific literature (Millard-Ball et al. 2005), it should not be taken for granted (Stillwater, Mokhtarian and Shaheen 2009), and Rome may serve as a case in point of such uncertainty, the quality of transit in the CS districts being rather good but, at the urban level, not adequate to the citizens' needs. Finally, when locations are very close to one another (the average distance between two locations is about 400 meters), CS members seem to have no preference, as each user has, on average, three different equally-favorite locations.

The survey outcomes and the general features, reported in Table 2, qualify the four districts as good examples of the three Ds - Diversity, Density and Design realm (Cervero and Kockelman 1997), and indeed the districts' compact settings, very mixed land use and high quality environments do contribute to a less car-addicted lifestyle, in which existing preference for walking may be assumed as a reason to implement CS. A further analysis on the users' typical profiles seems to substantiate this.

### *3.4. A CS member's profile*

The operator database provided general information on CS members (62% are males, aged between 31 and 50), but also data useful in determining favorite locations. The knowledge of "who goes where" may provide information not only about the average distance each CS member walks or drives to reach the chosen locations, but also whether there are clusters of members at a given area, useful in explaining why some locations appear to be preferred, besides the above-mentioned assumptions on land use and proximity patterns. By crossing data about possible clusters of users and favorite destinations, it is also possible to determine some indicator values for the success of these locations, as a threshold for the feasibility of the CS planned expansion.

To know "who goes where" the first step was to link postal code of each CS member to the postal code(s) of the locations he/she selected during 2009, using an O/D matrix (91 rows in which users are clustered by postal codes and related districts x 61 columns in which locations are similarly reported). The matrix provided 800 O/D pairs with non-zero trip demand: 422 out of them belong to districts where CS is already operational, 136 to the four districts where new operations are in development according to the expansion plan, and the remaining 242 to areas where no CS operations are planned at all. Approximately 22% of these pairs refers to CS members and locations in the same districts, but the conversion of such a percentage in number of leases highlights that there are two clusters of Car Sharers: those (1,147 units) who use locations in the same district where they live, and those (1,053) who "migrate" to other districts to lease the cars; within the former, also defined as the "resident" CS members group, the majority choose locations operational since the early stage of the service (i.e., the initial cluster of 22 parking areas active since January 2008), thus suggesting a kind of fidelity.

In order to gain knowledge about average times and distances travelled, a full-featured Geographic Information System (GIS) model, designed specifically for planning management of transport systems, was used to map members' home-to-CS parking trips. Modelling was based on the following hypotheses:

- "Resident" CS members walk to reach the selected CS parking, whereas the "migrant" ones drive;
- For each location: the average walking distance which qualifies "resident" Car Sharers for the status of "main" member is <2 km (average speed: 4 km/h); the average driving time which qualifies "migrant" Car Sharers for the status of "main" member is <40 minutes (according to the enforced speed limits and modelled traffic schemes).

The <2km-walking distance and <40min-driving time criteria are based on the assumption that increased walking distances or driving times are not realistic: indeed, the former could hardly be considered as ancillary walking to the car, the latter would not "match" the city mobility "lifestyle" since during peak hours the average driving distance per trip is 12.5 km which corresponds to a 45 min. drive. Cycling has not been considered as an option, being the mode not popular in Rome. According to such assumptions, the amount of both main "resident" and "migrant" members recorded in any location is never below 80% of the total number of car sharers, but there are locations (mainly those in “pure” residential areas) where 100% of main “resident” membership is registered.

“Main Residentship” becomes, therefore, a deeply relevant parameter in assessing the success of a given location, because it provides information on the amount of members who consider the service a form of transit and are willing to walk to use it; on the contrary, those who migrate to pick up the car can be considered from a different point of view: “lured” by the possibility to enter the LTZ or free parking, they are ready to drive, just out of personal convenience. Consequently, “Main Residentship” has been assessed considering two indicators: the average walking distance (in meters) to each CS location and the CS Residents Indicator (CSRI) calculated for each location as the number of Main Resident CS members/average walking distance. CSRI (average value: 8) highlights a discrepancy between the values calculated from the cluster of 22 locations open since the early stage of operations and those of the 61 currently operational, the former being about four and the latter around 16, which still suggests fidelity for the cluster of 22 locations. The average walking distance, calculated on the GIS-map, is 530 m and suggests that each location has its own theoretical catchment area, as in Figure 1. It is notable that the average walking distance at the early stage of operations (January – March 2008) was about 800 m, and this value progressively decreased as more locations started to become operational.

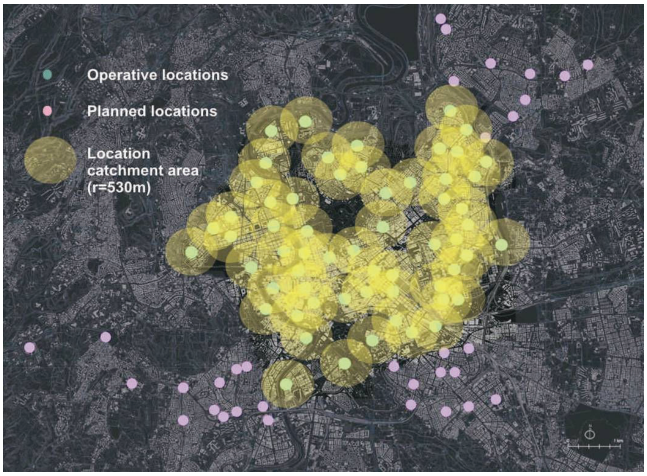



Fig. 1. Locations catchment areas

## 4. Assessing the role of the built environment

The general statement that CS goes hand in hand with walking is realistic for the Rome case; for some very central locations with mixed land use, “resident” CS members seem to tolerate longer walking distances (up to 800 - 900 m) when no cars are available at the favorite location(s), whereas at locations in monofunctional areas (mostly residential) and often with poor transit supply, such values markedly decrease (around 400 – 200 m), as if CS were perceived as a transit option more accessible from home than from bus stops or metro stations, which on average are farther. A first interpretation of why CS members seem to accept long walks to lease their cars may rely, not only on the 3Ds, but also on the acknowledgment that very different urban functions and outdoor activities are supporting factors for walking, thus suggesting that both walkability and the quality of the built environment affect CS operations. To translate such an interpretation into quantitative parameters, the built environment typical of each location has been assessed according to three evaluation categories: a) road network density; b) road network connectivity; c) pedestrian proximity.

The road network density was assessed through four basic indicators: number of nodes; number of links; nodes' density (nodes per hectare) and links' density (links per hectare); calculations have been made by a GIS-based software, considering for each location an 800m radius area (such a radius being compliant with the average walking distance registered during the early stage of operations); the number and the density of bus stops was calculated in the same way.

The road network connectivity was calculated through two indexes α and γ (Zhang and Kukadia 2005), which allow the assessment of the accessibility to each CS location. On the basis of the same 800m radius area, for each location, α and γ indexes assess whether the amount of nodes and links (and hence intersections) may favor the pedestrian accessibility; each intersection represents a possible choice each pedestrian can make to optimize the O/D trip; on the contrary, large and long blocks (and hence a low intersection density) compel pedestrians to plan longer routes, having fewer choices. Both indexes may vary from 0 to 1, and the highest values correspond to the best achievable connectivity. Lowest α and γ values have been found in virtually all of the not-central locations, to which correspond the lowest values of the road network density indicators.

The last assessment category, i.e. pedestrian proximity, is based on a well-known indicator: the Pedestrian Catchment Area (PCA), which has been adapted to the Rome case as the ratio between the actual walkable area by a pedestrian (AP) and the influence area (IA) of each location, calculated as an 800m radius circumference). Figure 2 summarizes all three evaluation categories for two situations (compared to the 61 locations' average values), showing on the left a typical CS location (Nicosia) in the historic area of the First District, with mixed land use and good transit supply, and on the right a typical location in monofunctional areas, in this case the Pinturicchio residential area on the fringe of the Second District.

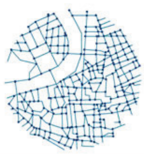
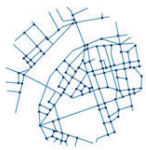
| Indicators | Location | Nicosia | Pinturicchio | Average* |
|---|---|---|---|---|
| pedestrian proximity | PCA (AP/IA) | 0,75 | 0,25 | 0,51 |
| | |  |  | |
| road network density | Links (units) | 503 | 272 | 165 |
| | Nodes (units) | 291 | 161 | 280 |
| | |  |  | |
| | Links Density (units/ha) | 2,52 | 1,36 | 1,40 |
| | Nodes Density (units/ha) | 1,46 | 0,81 | 0,82 |
| road network connectivity | α index = (n°links – n° nodes +1)/[2(n°nodes)-5] | 0,37 | 0,35 | 0,36 |
| | γ index =(n°links)/[3(n°nodes-2)] | 0,58 | 0,57 | 0,57 |
| * 61 locations | | | | |

Fig. 2. Assessment of the built environment for two CS locations

## 5. Where to transfer the service: operational feasibility and quality of the built environment

According to the above-described analysis, in a city like Rome, mere operational efficiency is insufficient to assess the capability of a given location to accommodate a CS parking; consequently, reasons to upscale the CS service must rely both on technical viability and context appropriateness. Therefore, the parameters to assess whether CS operations are transferable to other areas of the city have been divided into two categories: a) operational feasibility, and b) quality of the built environment. Both categories were used not only to assess the new 36 sites eligible to become new CS locations, but also to contemplate the possibility of moving elsewhere the already operational locations which have appeared to be, so far, less-favored, in terms of registered leases. Additional considerations about the users' typical profile (gender, age, registered address, etc.) have been also used to corroborate the assessment process.

Assessing the prospective locations (and their 500 prospective "resident" CS members, according to the O/D matrix) is a rather sensitive task, as many sites are in the outskirts, not likely to meet the high quality requirements of the built environment the majority of the operational locations have; as a matter of fact, they are purely residential, lower density areas, with poor retails and public facilities and even poorer transit supply. This means that it may be difficult to attract more customers than the already 500 CS members (who use the service out of personal convenience, being currently compelled to walk or drive much more than their "resident" peers) in areas where the dominant modes are forcibly private cars. The operational feasibility, hence, has been calculated starting from the level of the service so far documented, and aimed at simulating the basic level of service needed to launch and maintain the service successfully in the new locations; more specifically, threshold values for a set of indicators have been calculated according to two scenarios to confront the possible initial inertia among the citizens towards the service: a kick-off phase and a consolidated phase, the former corresponding to the very starting phase (first month of implementation) and the latter to the situation after three months of activity (Table 3). As concerns the quality of the built environment, prospective locations are positively assessed and hence deemed suitable to accommodate CS parking only if values of two out of the seven indicators reported in Figure 2 are below average, which led to the relocation of 31 candidate sites out of the planned 36. Similarly, threshold values of the indicators of both the assessment categories have been also used to reconsider the efficiency of the 61 locations currently operational. Indicators' values showed that seven locations (six in residential areas) could not meet both the requirements of quality of the built environment and operational feasibility and therefore will be relocated.

Table 3. Operational feasibility: threshold values

| Indicators (monthly average values per location) | Scenarios | |
|---|---|---|
| | Kick-off | Consolidated |
| Actual members (units) | 12 | 14 |
| Local lease (units) | 37 | 43 |
| Local mileage (travelled km) | 1,441 | 1,612 |
| Local usage (lease hours) | 194 | 224 |

## 6. Benefits for the community

As environmental benefits from CS often go unnoticed, the second goal of the expansion plan was to highlight and make citizens better aware of the contribution of the operations run so far to improving air quality and livability. Air quality improvements have been calculated in terms of reduction of the "emission package" due to the circulation of the CS fleet, whereas increased livability has been assessed in terms of the capability of the service to save urban space and provide health benefits (calculation methods are detailed below).

### *6.1. Air Quality improvements*

As for the emissions study, calculations were based on the composition of the CS fleet, which is made up of conventional gas-fuelled, EURO 4 and 5 compliant vehicles; CS vehicles are newer (two years old) and better maintained than the average registered vehicles in Rome (about eight years old), the majority compliant with pre-EURO 4 and 5 standards (i.e., 60.4% corresponding to about 1,160,000 vehicles, according to the Rome Municipality Mobility Plan). A comparison between pollutants (CO, $CO_2$, NOx, PM, NMVOC) emitted by the CS fleet with those emitted by the registered fleet of privately owned cars was made, considering the km travelled for each type of vehicle available in the CS fleet for 2009 (total value: 720,000 km) and applying average emission factors based on the fleets composition in terms of type of vehicle (passenger cars), vehicle category (Diesel >2.0l, Diesel <2.0l, Gasoline <1.4l, Gasoline 1.4-2.0l, Gasoline >2.0l) and engine technology (EURO requirements), according to the COPERT parameters (SINANET 2009). The comparison (Figure 3, where results for 2009 are described) shows that most relevant reductions can be achieved for NMVOC and CO (respectively - 81% and - 64%).

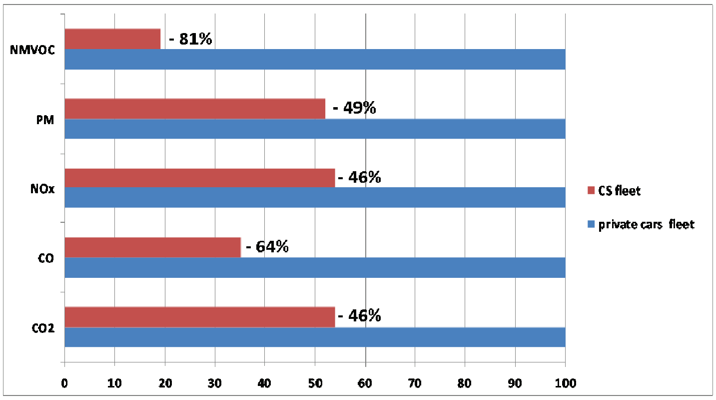



Fig. 3. Emissions comparison between the CS and the registered fleet in Rome, 2009

### *6.2. Increasing livability*

Regarding other achievable benefits, some livability indicators (Table 4) stress the mutual relationship between CS and the built environment. The numbers of privately owned cars replaceable by each CS vehicle and the related reduction in terms of circulating cars have been estimated; both livability indicators were based on the annual number of actual CS members and the average number of passenger cars per inhabitants in Rome (0,67 according to the Rome Municipality Mobility Plan ). Consequently, such results prompted the assessment of two more indicators, i.e. the "reduction of on-street parking pressure" pertaining to the space that would be saved by parking each CS vehicle instead of that required for privately owned cars replaced, and the "saving space potential" for the space saved to perform a 10 km-long trip during peak hours thanks to a CS vehicle replacing the privately owned cars. The translation of the reduction of on-street parking pressure into free pedestrian areas corresponds to the area covered by a renowned Roman square: the Spanish Steps. Having acknowledged walking as a key factor to support CS, it was important to assess how it can affect CS members' health. The Steps in Reserve method

(Morency, Roorda and Demers 2009) estimates that the average CS member, who makes at least 40 leases per year and has to cover the 530 m average distance to lease the CS vehicles, walks 53,000 steps which correspond to a total length of 42.4 km per year and a 2,200 kcal annual average energy expenditure.

Table 4 Livability indicators

| Indicators | 2008 | 2009 |
|---|---|---|
| CS replacement (private cars replaced by each CS vehicle) | 16 | 14 |
| Reduction of circulating private cars (units) | 656 | 742 |
| Reduction of on-street parking pressure (sqm) | 7,872 | 8,904 |
| Saving space potential (km*sqkm) | 11,808 | 13,356 |

## 7. Conclusion

Environment is a key parameter in assessing the feasibility of CS, since it plays a double role: if it is considered in terms of physical context, i.e. as built environment, it can provide useful direction to optimize operations, enhancing eco-friendly habits of Romans, in this case walking; if it is considered in terms of achievable goals, i.e. as improved air quality and livability, the study results stress that even such a minor measure can contribute far beyond expectations. Such considerations and the operations results, above described are currently paving the way for the implementation of the new 72 vehicles at the 36 new locations across the city, which is expected to take place by the end of 2012.

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