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Impacts of tour buses in Rome

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Abstract

The regulation of tour bus (TB) traffic in cities, especially major tourist destinations, is of undoubted interest for the policy maker, who must balance accessibility with protection of the architectural-artistic heritage.

The paper is based on the authors' study of TB, which showed that technologies that reduce diesel emissions brought clear improvement, especially on Euro VI buses, in comparison with diesel cars. The study verifies the validity of the regulation by evaluating the real impacts of TB through data provided by official agencies and traffic simulations. Data from monitoring stations revealed no correlation between an increase in TB and absolute values of pollutants. Pollution in Rome is largely caused by cars and powered two-wheelers, clearly preponderant in km traveled.

TB access-regulation policies in a sample of seven European cities (Florence, Milan, Berlin, London, Paris, Stockholm, and Rome) were examined in detail and found to vary greatly. In Rome, Florence, and Milan, the longer the vehicle, the higher the access fee paid. This is in contrast to London and Stockholm, where larger buses are exempted from the congestion charge.

The study noted substantial differences between Italy and Central/Northern Europe in the attitude toward TB. In London, Stockholm, Paris, and Berlin, TB are regarded as a resource to reduce traffic and pollution and for the economy of the city.

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1. Introduction

Tour buses (TB)¹ are used in cities for group travel. Tour operators may combine tourists who have purchased individual travel to provide greater comfort as well as better access to airports, hotels, restaurants, museums, and other attractions than public transport could. Groups from cruise ships often book buses through maritime agencies. Other kinds of groups also use TB, as for school, parish, club, or company excursions. The main advantages of TB are the efficiency of a collective transport and, rare for collective means, profitability. But, especially at major tourist destinations, TB should reconcile the need for access with protection of the environment and the architectural-artistic heritage of the historic centers.

Conflict is inevitable. Any solution to this dilemma must overcome technological, social, economic, and cultural aspects of diverse origins—technological improvement of cars, structural insufficiency of the road capacity and parking areas, and the desire of owners to use and park their cars, which is contradictory in and of itself. The objective is not unique, and the presence of an elevated sensitivity on the part of the social groups makes the conflictual aspects more acute.

Reducing general traffic, as occurs spontaneously on Sundays, requires a carrot and a stick. The carrot would have to be better public transport, the stick new costs, such as fees to enter the entire urban area, and increasing the extremely low parking fees. Such provisions are very much in conflict with the behaviors of the citizens and the monopolistic and corporative management of public transport.

The path of least resistance has therefore been to make a scapegoat of large TB, with their diesel engines and the herds of foreigners who ride them. “If a man be gracious and courteous to strangers, it shows he is a citizen of the world”, wrote Sir Francis Bacon some 500 years ago. But the stranger in our midst is viewed more as an annoyance than as a resource.

Residents are thus assured that it is not they—with their 2 million cars—who are guilty of polluting the city. The real culprits, they are led to believe, are the, at most, one thousand TB that come to town during the tourist season and which require the equivalent of only about 3000 car parking places. This “discovery” of the “true” villains has been widely publicized in the press, and everyone has been happy to see the “monster” unmasked on the front page, at least of the local news.

The objective of this paper is the evaluation of the real impacts of TB on Rome, how to regulate their traffic and to demonstrate their economic sustainability. This topic seems to have never been treated in the scientific and professional literature. Only a handful of articles, Albaladejo and Bel (2010) and Le-Klähn and Hall (2014), mostly in the literature of the tourism management sector, address transport aspects of tourist flows in the large urban centers.

This paper is organized as follows. The next section shows the effectiveness of emission reduction technologies on buses. The second section contains a review of European regulations regarding vehicular and TB traffic. The third section covers the transport and environmental impacts of TB in Rome, including the results of simulations relative to vehicle-km and parking space of the various traffic components. The results of an empirical analysis, based on data from pollution monitoring stations in the city aimed at evaluating the weight of TB in the quantities of pollutants measured by the stations, are reported. The paper concludes with some considerations on transport policy.

2. Technologies for the reduction of pollutants and emissions of heavy-duty vehicles

Few studies estimate the real emissions in urban traffic and compare the emissions of Euro VI heavy-duty vehicles with those of Euro 6 cars in the same real conditions.

A study conducted in 2013 on behalf of the Netherlands Ministry of Infrastructure and Environment (TNO, 2013) found that, in spite of the tightening of the Euro limit value, Euro 6 diesel cars produce about 500 mg/km of NO_x in real driving conditions, a quantity very similar to that emitted by Euro 4 and Euro 5 cars. Likewise, a 2014 study conducted by the International Council on Clean Transport (ICCT, 2014) based on road tests with the Euro 6 diesel

¹ The term tour bus is not strictly accurate; the subject of this paper is the transporting of tourists by rented bus with driver. This activity is regulated in Italy by the national framework law of 11 August 2003, no. 218.

cars showed that, on average, NO_x emissions in real driving conditions were about 560 mg/km, that is, seven times higher than the Euro 6 limits (80 mg/km). Indeed, at those dates, test cycles for cars were based on the NEDC (New European Driving Cycle) protocol, replaced today by the WLTP (Worldwide harmonized Light vehicle Test Procedure) protocol which is designed to simulate real-driving conditions.

As for heavy-duty vehicles with Euro VI engines, the new test cycles have come into use: the World Harmonized Stationary Cycle (WHSC) and the World Harmonized Transient Driving Cycle (WHTC). The new certification cycles have made the emissions of heavy-duty vehicles more consistent with emissions in real driving conditions, making still more explicit the need to adopt new certification cycles for light commercial vehicles and for cars.

Since 2015, the Norwegian research institute TØI and VTT, the Swedish Ministry of Transport, have been conducting a study based on measurement of 12 heavy-duty vehicles with Euro VI engines and seven Euro 6 diesel cars (TØI, 2015). The Euro 6 diesel cars were found to account for three times the emissions of NO_x as Euro VI buses in conditions of urban driving (0.35 g/km against 0.12 g/km). Moreover, the study proved that diesel cars emit 4–20 times the legal limit of NO_x. Latest-generation heavy-duty vehicles, including Euro VI city buses, have low NO_x and PM emissions—more than 90% less than the previous generation. But the traffic pollution problem is not the diesel car: “Ditching diesel won’t clear the air” (Platt *et al.* 2017).

3. Access-regulation policies in Europe

The CLARS platform (Charging, Low Emission Zones, other Access Regulation Schemes), an initiative of the European Commission, makes available on its website² a review of the access-regulation policies in the European Union designed to offer background information and updates.

Other resources include the on-line course developed under the European Commission’s CIVITAS initiative DTV Consultants and Sadler (2016) and the report for the ADEME on LEZ in Europe (2016). Guidelines for the definition of access-regulation policies have been produced by the DG Environment of the European Commission, ECORYS and MWH (2014), and ECORYS (2014), and a similar initiative is under way by the DG MOVE.

Policies for the regulation of vehicle access to urban centers are based on bans and pricing. They comprise a broad set of measures, such as Low Emission Zones (LEZ), Congestion Charging Zones (CCZ), Limited Traffic Zones (LTZ) based on permits (sometimes paid), pedestrian zones, and other restrictions on specific vehicle types.

Policies based on bans and pricing by emissions class are an effective incentive to renewing the fleet, as evidenced by the case of Stockholm (Whitehead *et al.*, 2014). The revenues from pricing can be used to cover the costs of access regulation and/or to finance compensation of certain social groups for the additional costs that the access regulation imposes, for example, measures to improve public transport and reduced fare.

The guidelines of the DG Environment, ECORYS (2014), regarding LEZ propose a framework legislation at national level, based on that existing in Germany and harmonized in the countries of the European Union, to define the emission classes (PM and NO_x) for LEZ and the timetable for the transitions between classes. The individual cities may choose which vehicle classes to authorize according to the local pollution-reduction objectives. Suggestions have been provided on the criteria to be adopted to set the level of the eventual cost required for granting permits, on providing information to residents and visitors, and on how to evaluate ex-ante and monitor the policy.

Good European practices, regarding the regulation of access for traffic in general, are the following:

- Pricing measures in preference to bans, since pricing gives users the opportunity to adjust behavior on the basis of the value assigned to the journey.
- Implementation of access measures and parking charges to reduce traffic in central areas that apply to all vehicles; traffic reduction increases speed, which today is low, and decreases emissions.

² www.urbanaccessregulations.eu. Hundreds of European cities have vehicle entry regulations, depending on vehicle emission standards, payment or vehicle type, etc. The portal gives all the information on low-emission zones, congestion charging, and other access regulations in Europe.

- Use of surcharges for the more polluting vehicles to create incentives for fleet renewal. The combination of the congestion charge with the emission surcharge implemented in London is exemplary in this regard.
- Imposition of charges aligned with external congestion and environmental costs actually generated. The currently observed reduced transfer of resources from the central government to the municipalities should not be such as to force the cities introduce new forms of taxation on cars and TB for the sole purpose of recovering the lost cash.
- Adoption of a single, national set of regulations and prices, taking as model Germany's LEZ.

Regarding TB specifically, the following interventions are suggested:

- Simplify the regulations and make information clearer and easier to find, with other languages.
- Facilitate bus parking; provide enough parking places for short- and long-term parking as well as information systems to direct the buses to them; where feasible, allow TB to use ordinary bus stops.
- Give priority, e.g. by permitting the use of bus lanes, to larger TB, in recognition of their lower per-passenger emissions and occupied space.
- When a CCZ is in effect, adopt the same charge levels for TB as for other vehicles.
- Provide incentives to modernize bus fleets with Euro VI vehicles.
- Implement public information campaigns to assure citizens that TB do not pollute, worsen traffic, or hog parking space, and that violations by drivers can be detected and will be stopped.

The study examined in detail the TB access-regulation policies in a sample of European cities: London, Paris, Berlin, Stockholm, Milan, Florence, and Rome. The specific TB policies were found to vary greatly.

Limitations on access for the worst polluters are usually related to the existing LEZ. When a CCZ is in effect, TB may either be subject to a surcharge that increases with the length of the bus, as in Milan, or be exempt, as in London (TB with 9 or more seats) and Stockholm (TB heavier than 14.5 metric tons). In London, the only case, an emissions surcharge (also called T-Charge, for toxicity) is in effect in the same area of the CCZ. The surcharge applies to all pre-Euro 4/IV vehicles, including TB.

In the absence of a CCZ, a paid circulation permit specifically for TB is required in Rome and Florence. The permit price is differentiated for areas, with discounts, surcharges, and exemptions by emissions class and/or vehicle length. There is a quota of permits.

Specific bans for TB could be applied in zones subject to traffic calming, as in London, or in historic centers, as in Florence and Rome. Differentiated provisions are made everywhere for TB that transport disabled passengers.

We evaluated access-regulation policies using four criteria (Table 1): (1) clarity of information presented and number of languages into which it is translated, (2) complexity of the regulations, (3) availability of TB parking places, and (4) consistency and fairness of the provisions. Provisions are considered consistent when the fee slides according to the emission class of the vehicle. A provision is fair when it is consistent and the price is in proportion to the emissions of the vehicle per passenger for passenger vehicles and per metric ton for freight vehicles.

The presentation of the information in terms of languages used is inadequate in Rome and Florence. The regulations for TB access are complex and the tariff scheme hard to understand, but even Paris has a complicated system for parking permits. The availability of parking places is unsatisfactory in Stockholm, Milan, and Rome. More in-depth studies of the parking demand for all seven cities are advisable. The consistency of the measures is satisfactory only in London and Berlin. The measures are not fair in any of the cities, since pricing is not proportional to the emissions per passenger for passenger vehicles and per metric ton of cargo for freight vehicles.

We find that Berlin has the best overall access-regulation policy and London the second best. The bottom three places are occupied by the three Italian cities, Milan, Florence, and Rome.

Table 1. Criterion-specific and overall evaluation

City	Presentation of information	Complexity of regulations	Availability of parking spaces	Consistency and equity of provisions	Total evaluation
Berlin	3	3	3	2	11
London	3	3	2	1	9
Stockholm	2	3	0	0	5

City	Presentation of information	Complexity of regulations	Availability of parking spaces	Consistency and equity of provisions	Total evaluation
Paris	2	1	1	0	4
Milan	2	2	0	0	4
Florence	0	0	1	0	1
Rome	0	0	0	0	0

4. Impacts of tour buses: the case of Rome

The study area was the so-called LTZB, a centrally located area of 8 km² that includes the Vatican, the historic center, and the main rail station, where TB are subject to a number of constraints and a special tariff. A traffic simulation based on the equilibrium user assignment with the software Transcad® estimated the km annually traveled by all road-transport means in the study area and the corresponding passenger-km (pkm). To estimate how many TB are circulating in Rome each year, the study counted the daily permits and annual subscriptions granted by the city in 2016. In 2016 (see Fig. 1), about 87,000 daily permits were granted, that is, on average 239 buses with daily permit circulating per day. There are two peaks of traffic, one in April/May and the other in September/October with four times as much traffic as in the low-traffic months.

Table 2 gives the overall annual km travelled within the study area by local public transport services, TB, private and freight traffic, the equivalent car-km, and the pkm per year. The pkm/y was estimated based on a hypothesis of the average number of passengers for each means of transport. Hop-on/hop-off buses are distinct from TB. TB represent about 2% of vehicle-km travelled, but they carry, in terms of pkm/y, 42% of car and motorcycle passengers.

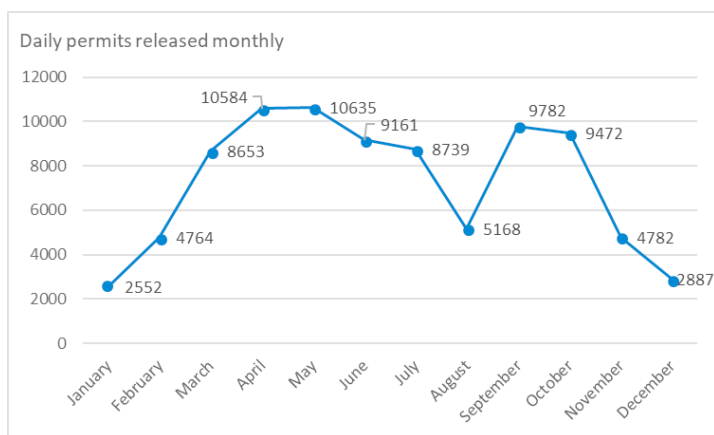


Fig. 1. Number of daily permits issued by Rome municipality in 2016

Source: Mobility Services Agency Rome 2017

Table 2. Comparison of absolute annual km production within the study area

Traffic study area	Vehicle-km/y (mln)	Equivalent car-km (mln)	Avg. no. passengers per vehicle	pkm/y (mln)
Tour buses	7.8	15.6	25.0	195.0
Open Bus	1.0	2.0	30.0	30.0
ATAC	11.5	23.0	40.0	460.0
Cars, powered two-wheelers	352.0	352.0	1.3	457.6
Commercial vehicles	23.1	34.6	—	—

The amount of space occupied by TB in the LTZB area in comparison with that occupied by private vehicles (car + motorcycle) for the morning rush hour is given in Table 3.

The most interesting indicators are the parking spaces per passenger used by private vehicles—5.2 (m^2/p) as against 0.6 for TB, almost a tenth—and the parking space used by TB as percentage of the total, only 3.6%, but 42% of private-vehicle passengers. This confirms TB efficiency in the use of urban space.

The impacts of traffic on the 13 pollution monitoring stations in Rome were evaluated empirically using data from ARPA (Regional Agency for Environment, Lazio 2017).

Table 3. Parking space used by private vehicles and tour buses at rush hour in study area

Private vehicles (m^2)	190,000
Private vehicle passengers (p)	36,416
Parking space per passenger (m^2/p)	5.2
TB (m^2)	7,170
TB passengers (p)	12,000
Parking space per passenger (m^2/p)	0.6
Total parking space (m^2)	197,170
TB parking space % of total	3.6

Fig. 2 gives the concentrations of pollutants (NO_2 and PM_{10}) in Rome. The peak is in winter, when there are fewest TB (see Fig. 1), and there is no change when the number of TB increases.

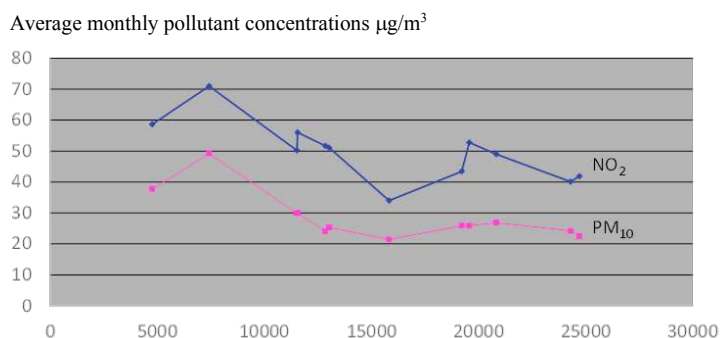


Fig. 2. Average monthly pollutant concentrations as monthly number of TB increases, 2016. Source: ARPA 2017

Fig. 3 gives the averages of the concentrations during the week for 2016. The concentrations increase until Friday, then decrease at the weekend and are lowest on Sunday. Between Friday, the day with the highest concentration, and Sunday, with the lowest, there is a difference of about 12% of NO_2 and 27% of PM_{10} .

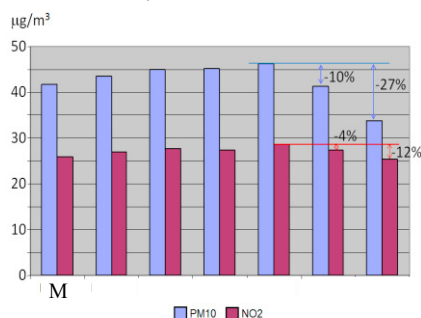


Fig. 3. Average concentrations of NO_2 and PM_{10} in 2016. Source: ARPA 2017

The variations in pollutants are explained by the average daily profile of the number of vehicles in Fig. 4. The reduction of the traffic among weekdays, pre-holidays, and Sundays and holidays is about 12% and 27%. When there is less general traffic, the pollution monitoring stations show a proportionate reduction in the pollutants.

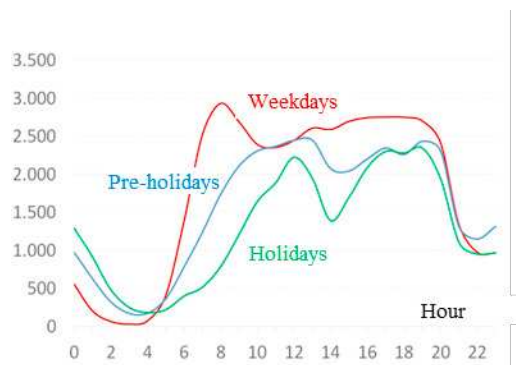


Fig. 4. Average daily profile of number of vehicles
Source: Mobility Services Agency Rome 2017

The diminution of traffic permits higher speeds, and this too contributes to the diminution of the pollutants. Fig. 5 shows the variation of the average speeds on the days of the week.

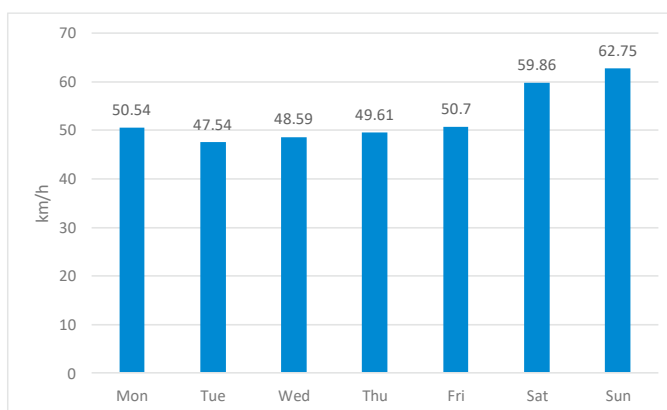


Fig. 5. Average speeds of traffic flows
Source: Mobility Services Agency Rome 2017

5. Conclusions

Rome, Florence, and Milan oblige TB to pay for access to the central areas. Unlike London, neither Rome nor Florence differentiates greatly by vehicles' environmental performance. In both cities, information is scant, and regulations are complicated.

In Rome, Florence, and Milan, the longer the TB, the higher the access fee. This is in contrast to London and Stockholm, where larger buses are exempted from the congestion charge because bigger means more efficient.

The study has called attention to substantial differences between Italy's attitude toward TB and Northern Europe's. In London, Stockholm, Paris, and Berlin, TB are regarded as a resource to reduce traffic and pollution and for the economy of the city.

The simulations conducted for Rome confirmed that TB are efficient in impact on both circulation and occupation of space. The same can be said of ordinary city buses, but TB offer better accessibility, greater comfort, and, not being subsidized, greater economic sustainability.

The empirical evidence on the basis of the data from the pollution monitoring stations revealed no correlation between an increase in TB and absolute values of pollutants gathered and exceedances registered by the stations, although absolute values of pollutants and exceedances have proved sensitive to variations in general traffic in the comparison among weekdays, pre-holidays, and Sundays and holidays. The problem of pollution in Rome, as in all the cities examined, is cars, clearly preponderant in terms of km traveled. Policies should therefore be directed primarily at cars.

This is the approach adopted in Rome's traffic master plan, issued in 2015. The plan foresees access pricing generalized for a large limited-traffic area between the historic center and the outer ring road (GRA).³ The policy is difficult to execute because it faces opposition from a large number of citizens (most of the car drivers), who are somewhat justified by the poor public transport service. In fact, when a stricter paid-parking policy was attempted, the regional courts rejected it on grounds of the inadequacy of public transport. A severe pricing policy that affects only TB, as implemented by the current administration, has been opposed by fewer interested parties.

Yet such a policy would have disadvantages. For one thing, it would discourage group tourism. The reduction of tourist numbers in Rome would translate into a net loss of revenue for the area's hotels, restaurants, businesses, museums, and other attractions. Would the proceeds from the more costly TB permits offset the lost revenues from the daily tax the city charges every person who stays overnight in a hotel?⁴ There could also be redistributive impacts if tourism were to shift to other localities, for example, in favor of other so-called art cities or any of the other 52 UNESCO World Heritage sites in Italy.

To provide the same accessibility that large TB offer today, smaller buses (depending on the regulation adopted) or 8-seater chauffeur-driven minivans could be used. Either solution would offer better accessibility, but at a much higher cost per person in money, parking space, and environmental impacts.

Acknowledgments

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³ The so-called Railway Ring (Anello Ferroviario).

⁴ The *tassa di soggiorno*.