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&
ENERGY, ENVIROMENT AND SUSTAINABLE DEVELOPMENT
PROGRAMMES



MIRACLES Project GRD1 – 2001 – 40047

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1. Introduction

Before going into the technical details of the annex, it is the case to describe some changes that have occurred in Rome during the project lifetime from the organisational point of view, namely in the management of the Mobility at city level.

These changes have affected some of the measures implemented, some objectives have been revised and in some cases also delays have been recorded due to these changes. In fact 2 contract amendments have been submitted to the Commission, mainly due to the reasons described in the following:

At the outset of the project the two companies ATAC and STA, both controlled and owned by the Municipality of Rome, used to manage respectively the Public Transport and the private mobility issues. Competencies and tools concerning the objectives of the Miracles project used to be subdivided according to the following:

2002 - 2003	ATAC	STA
	Implementation of new PT lines	Access restrictions policies – Traffic control centre
	Information on board	Pricing policies
	Development/enhancement of the Infopoint	Car pooling Car Sharing
	AVM on PT	Flexible services (Taxibus)
Clean vehicles - buses	Studies on freight distribution	
	Mobility management	
	ITS – Environmental tools	
	Electric scooters	

In 2003 a first merger has occurred between the two companies, thus the competencies on “Sustainable Mobility” have been shifted to ATAC, according to the following:

2003 - 2005	ATAC	STA
	Implementation of new PT lines	Access restrictions policies – Traffic control centre
	Information on board	Pricing policies
	Development/enhancement of the Infopoint	ITS – Environmental tools
	AVM on PT	
	Clean vehicles - buses	
	Car pooling Car Sharing	
	Flexible services (Taxibus)	
	Studies on freight distribution	
	Mobility management	
	Electric scooters	

On 12th December 2005 the **merger between the two companies has been completed**, now all the competencies and employees of STA have been incorporated into ATAC, which is the only Agency for Mobility in Rome.

This process has led to the **integration** and concentration of all the competencies and activities on mobility in one only actor.

§ § §

This Annex constitutes the second MIRACLES Implementation Report and collects templates aimed at describing the main results according to two evaluation and implementation levels (and two formats): Measure Level Templates (MLTs) and City Level Templates (CLTs). (for

any additional information, please refer to subsection 3.3 of Deliverable 4.2 and to METEOR Guide for Completion of Evaluation Result Templates

Rome MLTs report main information on the implementation process of the MIRACLES measures.

Since some measures have been divided into more sub-measures, the templates have been structured accordingly.

Each Rome template is meant as a self-standing document; this explains why the reader will find some recurring information, namely those concerning the methods of measurements. Indeed, since some indicators have been measured at city level and/or contributed to assess more measures, it is appropriate that sub-section *M8 – Method of measurements* reports the same procedures for the same indicators every time they have been used.

Each template is divided into four sections which provide information respectively on: *the description of the measure, the implementation process, the evaluation process* and eventually *lessons learned*.

The **description of the measure** reports objectives and main functions of measures, as described in the Inception Report, in order to provide the reader with information on which activities were carried out to implement the measure.

The **implementation process** section describes how measures were implemented reporting the main actions required by such process and comparing the situation before MIRACLES/CIVITAS and the actual implementation, stressing innovative aspects. A special part of the section is dedicated to the "Design of the measure", where information on this issue, consistent with what already stated in the previous "Description of Work" and Projects Implementation Reports are reported. A revision of what planned in comparison to what carried out is provided in the "Deviation from the Plan" part, where for the Rome case study two main issues have been tackled: deviations in the implementation process, as a consequence of the amendment occurred in the second year of the MIRACLES Project, and deviations in the evaluation process, caused both by the implementation modifications and by the progressive awareness that some indicators previously selected resulted not anymore suitable. Reasons on the lack of data for some indicators are reported.

The **evaluation process** section describes main steps to assess the measures development. Since the evaluation methodology is in-depth described both in Deliverables 4.1 and in Deliverable 4.2 (according to the common evaluation framework developed with other CIVITAS projects), in this section more emphasis is addressed to directly-linked-to the-measures issues as the methods of measurements of values for the selected indicators along with the direct comparison between the ex ante and the ex post implementation process.

The core of this section is the study of the **indicators** as key-parameters to detect changes due to the implementation of measures. Such before/after situations are synthesized in structured tables (according to a format agreed among the evaluators) at M11 sub-sections of each templates, where indicators values concerning baseline, do-nothing and ex post situations are reported; those coming from the creation of do-something scenarios, when available, are provided as well. In this way, for each measure an ex ante/ex post results comparison table is available and main results are commented accordingly.

Since Rome is a complex environment, most measures are interrelated one to the others, and some changes occurred in the implementation process (as above stressed), the selection of indicators was affected by such aspects.

Even though local evaluators tried to meet METEOR Core Indicators requirements, the "palette" needed to be enlarged or modified in order to provide a realistic set of parameters to describe and assess the measures.

This meant that, on the one hand, some of the METEOR Core Indicators were not suitable or not applicable to describe some measures, because of practical hindrances in monitoring or achieving indicators data (and hence discarded); on the other hand that other extra-METEOR indicators were needed. This led the evaluators to select 36 indicators (i.e. 17 METEOR Core Indicators plus 19 extra indicators). Such amount of indicators is appropriate to evaluate all the implemented measures because a part of it (the METEOR Core Indicators) allows to compare local results to what achieved in other cities, even though it is methodologically evident that this is just a mere benchmarking exercise, and a part of it (the extra indicators, customized to assess some measures) prompt the evaluators to interpret some specially-targeted achievements. This is particularly relevant for some telematics-based measures where METEOR Core Indicators are not the most suitable tools to describe them.

The **lessons learned** sections provides recommendations and directions for further implementations.

Extra information can be also found in Deliverable 4.2.

2. Measure 5.1a – Access Restrictions to the Laboratory

MEASURE-LEVEL RESULTS	
Measure title: Set up of City Centre Clean Zone:	Project: MIRACLES
Measure number: 5.1a – Measures at Laboratory Area level	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Main objectives of the measure are: to improve traffic mobility conditions, increasing road safety and decreasing traffic related pollution, and to re-habilitate urban spaces, rationalizing public space, safeguarding citizens' health and life quality, and preserving historical and architectural heritage as well as to take advantage of ITS solutions for the AC purposes. All these goals are also shared by measure 5.2 "pedestrianization".</p> <p>Synthetic measure objectives are:</p> <ul style="list-style-type: none"> ❖ To reduce the impact of traffic on the environment ❖ To reduce the number of pollutant and poorly maintained vehicles in the study area ❖ To increase the level of protection of the city centre ❖ To insert access control system in Trastevere and S. Lorenzo districts 	
M2: Measure description:	
<p>The "Set-up of city centre clean zone" is a multitask measure, characterised by a very complex iter, in which the access control on central areas is the main issue (the measure description has been subdivided into 5.1a and 5.1b).</p> <p>The measure is applied both to the wider Laboratory Area and to specific LTZ zones inside, with the aim of implementing policy measures to limit the access to private vehicles, with the support of ITS measures:</p> <ol style="list-style-type: none"> 1. Set-up of access control limitations in the whole Laboratory Area to allow entry to catalysed vehicles only; 2. Fleet pollution control to increase environmental performance of the allowed vehicles with the yearly check-up of vehicles emissions to be extended to compulsory servicing of two-wheel motorcycles and mopeds, 3. the closure of the Access Gate System – ACS to be completed and integrated through the installation of a new access gate in via Dei Fori Imperiali; 4. two access restriction trials at S.Lorenzo and Trastevere districts to be transformed into structural measures with integration of new Electronic Access Control System (E-ACS) 5. extend the pedestrian mode in the Centre of Rome, mainly with the institution of "Tridente" pedestrian area and "LTZ A1" in the city centre, sometimes supported by the presence of mobile bollards. This part is discussed in Task 5.2 <p>The present template, 5.1.a details implementation and results of measures 1 and 2 at Laboratory Area Level, Task 5.1.b details implementation and results of measures 3 to 5, referring to the city centre LTZ or for a small zone (San Lorenzo or Trastevere district).</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The innovation mainly consists in the policies implemented during MIRACLES in the city, according to the general asset of the policies is increasing constraints accessing the inner zones and encouraging the use of peripheral inter-modal nodes. This policy is accompanied by complementary restrictive measures on traffic regulation and management. The "Roman Dream" is to have a "Clean zone" in the city centre, where alternative sustainable transportation modes like pedestrians are allowed, where pollution should be minimised.</p> <p>In the concentric scheme of the City, the MIRACLES Laboratory Area includes the inner two zones, where the limitations are higher and the Public Transport better: the access restriction to not-catalysed vehicles and the institution of the mopeds check-up as well as the completion of the on-street parking subject to payment in the whole laboratory area (Task 6.2) is representing the better support to the central Clean zones.</p> <p>As a consequence, the innovative added value of the City Centre Clean Zone of Rome is its strong integration and interrelation with the rest of the City and the high value of the technologies inside: here, the passage from human control to electronic scanning is now accepted at any level, from ATACkeholders to citizens.</p>	
M4: Situation before CIVITAS:	
<p>Before CIVITAS Project, no restriction in the inner zones of the city was applied to most polluting vehicles and</p>	

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

emission control was carried out only on the cars. The general Air Quality situation was bad also with regard to Benzene and Carbon monoxide, besides than PM10, NO2. Limits on Air Quality ATActus set out by National and European laws were regularly not respected and a prompt change towards “sustainable mobility” was necessary since the mobility is the predominant source of pollutant emissions in Rome.

M5: Design of the measure: Task 5.1.a Access Limitations in Central Zones

The Rail Ring “Anello Ferroviario” Policy

From 2001 to 2002, a series of Municipal Acts were issued in order to diminish the entity of the polluting emissions referred to the vehicular traffic in the central area of the city and to accelerate the renewal of the vehicular circulating fleet. The final act in December 2002 ATActed :

the Municipal Committee deliberated to allow till March the 31st 2003 the circulation inside the Railway Ring area to gas-fuelled vehicles not meeting the 91/441 CE (not catalytic) requirements, if they are supplied by the receipt of reservation for the GPL system's installation;

the Director of X sector of the Town Council of Rome determined, according to deliberation of Municipal Committee n. 790 and 797 of 23/12/2002, the prohibition of circulation inside of the Railway Ring area from Mondays to Fridays, with exception of midweek holidays, for the most polluting cars with spontaneous ignition (diesel vehicles matriculated according to directives before the 91/441/CEE) and for the most polluting automotive vehicles with command ignition (gasoline vehicles matriculated according to directives before to 91/441/CEE)

The electrical vehicles operating with GPL and fed with methane are excluded from the prohibition. Moreover, until the 31/12/2003, they have been excluded from the prohibition also the automotive vehicles used by the cinematography and television workers, only for the specific days, if previously authorised by the Municipality movies Office, answering to a specific and reasonable request.

Such provisions are applied to private or commercial cars. The policy do not expect the release of permissions for the residents. Only on-street verification made by the municipal police through the control of vehicle's documents is carried out.

This provision also makes exemptions for goods vehicles and the following specific categories of vehicles and road users from the ban until 31/12/2002, vehicles used to transport the disabled and displaying the proper disabled sticker, police and emergency services, emergency water, gas, electricity, telephone and traffic regulation services, waste collection and disposal services, collective public and private transport as well as taxi and chauffeur-driven car-hire services, in possession of appropriate council licence, vintage registered cars, as well as vehicles of doctors on emergency call situation.

The Rome Municipality prepared a specific advertising leaflet to inform all the citizens about the subdivision of the city into zones, where different limitations are applied. This leaflet (Figure 1) was distributed to the citizens through newspapers or available at all the information points of the city.

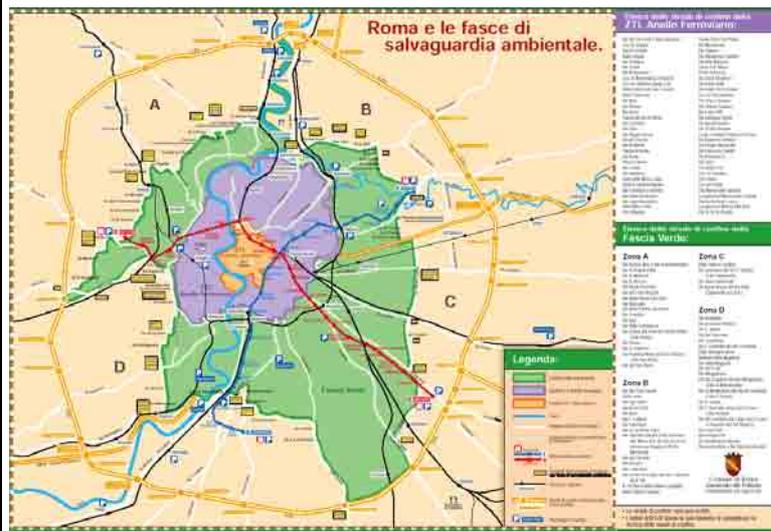


Figure 1 – Leaflet informing Rome’s citizens about the mobility limitations in the different zones of the city and where MIRACLES LA is indicated in blue

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

The blue sticker (“Bollino Blu”) Policy

By the Municipal Council Decree n. 1514/ 27/7/99, specific restriction measures on circulation have been set, including the obligation of exhausts control for the automotive vehicles on the Municipal territory, since January 1st, 2000.

With the decision of Dept. X of the Municipality (Environment) n. 326 of 3/08/1999, drafted after a City Council decision, it have been arranged the prohibition of circulation all over the Municipal territory to the automotive 4-wheels vehicles not equipped with "blue tag", to be carried out every 12 months from the date of purchasing, including those not registered in the Province of Rome. This blue tag certifies the car level of its exhaust gases was tested by an authorized centre, with the obtained emission values within the limits indicated into the directive 07/07/98 of the Ministry of Public Works and Ministry of Transport Decree of 28/02/94

The certificate of the yearly control must be exposed on the windshield of the vehicle and together with the certificate (which contains plate of the vehicle, date of the control and values of the emissions and that must be exhibited with circulation documents): it confirms that the concentrations of exhaust gases respect the law limits. The control of automotive vehicles' exhaust to internal combustion pursues the objective to improve the quality of the polluting emissions through the optimisation of the combustion inside the motors.

Such obligation offers the opportunity to acquire important data of the circulating cars in the Municipal territory, for example the typology of the vehicles (feeding, piston displacement, catalysed or conventional) and in the wearing down in terms of covered kilometres.

The collection of such information was given to the society Municipal Company for the Energy and environment (ACEA SpA.) of the Council of Rome, which is authorised to collect the cards, generally manually compiled from the mechanics qualifies, attesting the overcoming of the control. From January 1st, 2006, the “blue tag” controls will be carried out by ATAC, the Mobility Agency of the Rome Municipality

2-wheels control and PM emissions issue in Rome

Emission control was not compulsory for two-wheels vehicles until 1992 when Directive 92/61/EEC was introduced regarding EC type-approval for two- and three-wheeled vehicles, the regulations for which became compulsory only in 1999.

Particulate Matter (PM) and its concentration of suspended particles with an aerodynamic diameter of less than 10µm (PM10) was not, however, included among the regulated polluting emissions due to mopeds/motorcycles, although some recent studies have identified its presence in these types of vehicles. The effects of PM10 increase in proportion to its level of concentration although it is not known what the threshold level is, that is, the level below which it is not a health risk. Therefore the PM10 was considered a reliable indicator for studying the consequences of air pollution.

From the analysis of the current air situation, it is apparent that traffic is mainly responsible for the high pollutant concentrations. Traffic is the main source of CO, C6H6 and PM10 concentrations. High concentrations are recorded next to heavy traffic areas, whilst background concentrations do not exceed the limits. Recorded concentrations at the monitoring ATACtions show that the CO and Benzene concentrations have been strongly reduced in recent years, due to the enforcement of the limitation measures inside the “Railway Ring” measure previously discussed in 2002, with the circulation ban for vehicles without catalytic converters. On the other hand, PM10 exceeds EU limit thresholds periodically in three of the four monitoring ATACtions, confirming that this pollutant is the one on which most effort should be focused. The Municipality has the need of complying with new EU regulations for air quality like the Directive EU 99/30 and its “daughter directives”, especially the one regarding PM10 concentrations.

MEASURE-LEVEL RESULTS

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Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

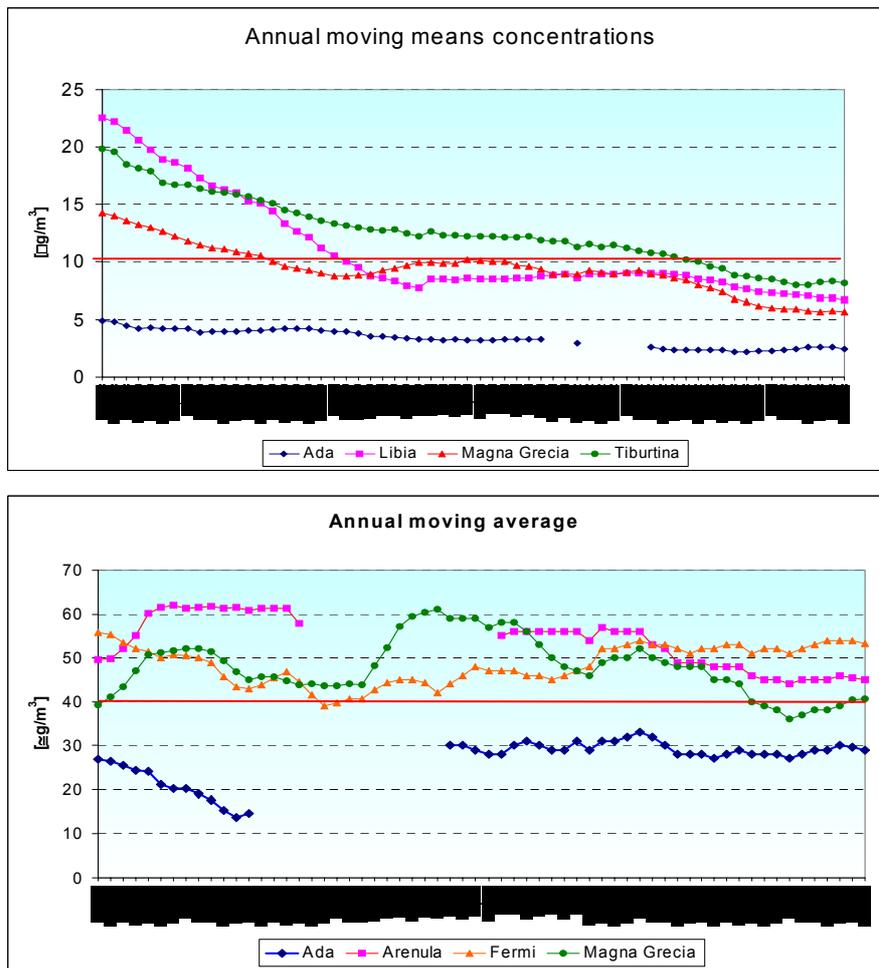


Figure 2: Trend of Benzene and PM10 concentrations in Rome from 10/98 to 11/03

According to mostly used and emission model COPERT III, approved by Environmental European Agency (EEA), only diesel vehicles are taken into consideration in estimating traffic-induced particulate emissions. Petrol vehicles, including mopeds and motorcycles, are not considered a source of particulate emissions. At the Casaccia Research Centre of ENEA (National research centre for Energy and Transport), experimental work has recently been undertaken to measure emissions of particulate matter produced by two-strokes mopeds. This study verified two-stroke engines release particulate matter. The ENEA studies, after that completed with analysis on 4-stroke motorcycle engines demonstrate that, even if mopeds and motorcycle are not subject to any PTS control during their homologation procedures, they seem to be responsible of more than 2/3 of cities centre PTS pollution.

According to these results, the Municipality is trying to force a renewal and the emission control of the motorised fleets. The "bollino blu" sticker was already demonstrating its usefulness in checking the situation of the 4-wheels private fleet in the past years: hence, the Municipality designed to extend this control also towards the 2-wheels fleet whose impact in Rome is very high. The implementation phases of this measure are described in the following.

Blue tag for vehicles with two wheels

From 31 January 2004 motorcycles and mopeds that have not had their exhaust gases checked by an authorized centre will not be allowed on roads in the City of Rome. Rome City Council is promoting the "Bollino Blu" initiative for two-wheeled vehicles in collaboration with ACEA (electricity and water provider).

With Deliberation of Municipal Committee n. 408 of 16/07/2003, it has been conferred mandate to the town councillor of the environment for the controls activation of two wheels vehicles' exhaust. The Municipal Administration therefore has established the prohibition of circulating all over the Municipal territory to the two wheels vehicles that have not carried out within twelve previous months the control of exhaust ("blue tag"),

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according to decree of the Ministry of Infrastructure and the Transport of 14/11/2001 and 20/06/2003, with the following expirations:

- ❖ from the 31/01/2004 for two wheels vehicles matriculated until 1993;
- ❖ from the 28/02/2004 for two wheels vehicles matriculated until 1994;
- ❖ from the 30/04/2004 for two wheels vehicles matriculated until 1995;
- ❖ from the 31/08/2004 for two wheels vehicles matriculated until 1996;
- ❖ from the 30/11/2004 for two wheels vehicles matriculated until 1997;
- ❖ from the 01/01/2004 for two wheels vehicles matriculated until the twelve previous months.

The attesting mark of control (“blue tag”) released by the workshops, need to be exposed and conserved together with the all the vehicle documentation. The certificate of the control is valid 12 months and must be renewed within the expiration of such period

M6: Actual implementation:

Limitation to entry the whole Laboratory Area to only catalyzed vehicles

Access restriction policy to not-catalyzed vehicles accessing the “Rail Ring” has been implemented in three different phases ATACrting from January to December 2002. It is considered one of the most important initiatives to reduce traffic congestion and air pollution undertaken by the City Council after the activation of the LTZ in the city centre.

Presently it is a structural measure, continuously working. As outcome of the Air Quality Report for the year 2004 in the city of Rome, completed in September 2005, a new plan was discussed by the Municipal Council in the year 2005. This plan, like the previous one for the year 2005, besides the confirmation of the limitation to not catalyzed vehicles to access the Laboratory area, included the application of alternate plates (odd or even) in 10 consecutive Thursdays of January-March 2006 and the total block of the circulation in Laboratory Area and beyond in two Sundays. The new plan for 2006-2007 has the structural measures regarding not-catalysed 2-wheel vehicles, that will not be permitted to access the Miracles laboratory area by 2007.

Extension of the yearly check-up of vehicles emissions to compulsory tune-up of two-wheel motorcycles and mopeds: an huge effort was carried out to promote this measure, also with specific advertising campaigns carried out by Municipal Company charged of the measure.

The 2-wheels “Blu sticker” is definitively entered into force for all vehicles since January 1st, 2005 and the results for the first year are detailed in M11. **Presently it is a structural measure, continuously working.**



Figure 3: Media advertising for the 2-wheels emission control

M7: Deviations from the plan:

The measures expected in this activity were applied according to the project schedule.

Indicators – Deviation from what planned in deliverable 4.1

See template 5.1b for comments on deviations from what planned in terms of indicators.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Given the high number of indicators several methods of measurements have been applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results. For what concerns methods of measurements on environmental and transportation indicators, these are the same also for 5.1b measures.

Environment indicators

Information on environment comes from air quality assessments concerning the emissions of CO, particulate and benzene. For the ex ante and ex-post evaluation, data from ATAC traffic control center were used. Here, due to the outcomes from measure 11.2.2 (see later) a complete traffic-environment chain was integrated, giving the traffic flow on the whole primary network of the Laboratory Area. The traffic information are converted

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into emission parameter through the integrated TEE model, supplied by ENEA. It calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry.

For what concerned pollutant concentrations, still indicators about CO, particulate and benzene were studied, mainly coming from Air Quality monitoring stations network in the city of Rome.

Moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration were carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution was available. In particular, air quality data were acquired by the monitoring stations of the laboratory area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives. Benzene was measured by a passive samplers method, i.e. the Radiello® diffusive sampler; these are samplers in which the diffusive and absorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially and parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface. The BTEX, sampled in urban environment by the cartridge are thermally desorbed.

Transport Indicators

For the baseline, and in general for the ex ante analysis, a big part of information concerning mainly the quantitative indicators was developed before, after and during the 2000 Jubilee. For this event esteems, models, surveys, measurements on the most relevant spots were run in order to quantify and to check impacts as the changes of traffic, of parking and of the Public Transport service. Such surveys were repeated after the 2000 Jubilee event thanks to other occasions, as other special events or other EC projects involving Rome. Besides, the set-up of the so-called “Mobility Observatory” in ATAC by the Mobility Department permitted a continuous updating of all the mobility data, thanks also to data coming from the ATAC Traffic Control Centre. Here, due to the outcomes from measure 11.2.2 (see later) a complete traffic-environment chain was integrated, giving the traffic flow on the whole primary network of the Laboratory Area.

Besides that, information coming from the Environmental Department of the Rome Municipality, especially from the yearly report on the air quality status in the city, were used. For what concerns Public Transport, the ATAC “infopoint” (a GIS based database) continuously provided information on the service. Hence, to describe the ex ante phase, most of quantitative information were obtained by existing database, which were continuously updated to collect data available for the ex post phase.

The impact of the limitation to entry the whole Laboratory Area to only catalysed vehicles on urban mobility was performed by ATAC throughout the analysis of detected traffic flows on predefined road carried out in four different campaigns (November 2001, February 2002, May 2002 e November 2002), one for each stage of the Rail Ring restriction policies implementation.

M9: Achievement of quantifiable targets:

For both 5.1a and 5.1b measures, the headline indicator is the reduction of the number of high polluting vehicles on the Laboratory Area by 10% and the increase in terms of emission control to the whole private fleet circulating in Rome, both 4 and 2-wheels. , the emissions in LTZ (including Trastevere), by 5% and the real number of permission to enter the LTZ, (including Trastevere), by 4%. Besides, the other main target is the general improvement of the air quality conditions inside the MIRACLES Laboratory Area, i.e. the Railway Ring of the City of Rome.

M10: Achievement of evaluation-related milestones:

Some very minor delays in the finalisation of some indicators occurred because of the complexity of the steps listed below; however this did not affected the evaluation process in general.

M1: “Anello Ferroviario” and “Bollino Blu”(Step 1: June 02; Step2: December 02; Step3: March 03) achievements: as planned.

M2: Annual Report on the quality of the Air inside the “rail ring” (month 12, 24, 36): as planned.

M11: Report on the measure results:

Results reported in this paragraph concern the outcomes, according to evaluation categories and indicators and to the measure’s general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex.

A comparison between quantifiable objectives and actual achieved results is reported at the end of M11 section of the 5.1.b template, since results achieved so far can be considered as coming from all the WP5 measures and the quantifiable objectives are common to them, as well.

General Outcomes

Environment

Air pollution, not easy to be evaluated in terms of effects coming from single local actions, has been reported as due to the general effect of all the Miracles measures that had direct impact on air pollution.

The comparison, in terms of concentrations, between the annual mean values, recorded in 2001 (Baseline) and

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the mean values in 2004 (ex post evaluation) showed a reduction of CO concentrations of about 21%, PM10 of 11% and Benzene of 37%.

Focusing on Benzene, in Figure 4, the mean values of such pollutant from passive sampler campaigns in background and hot spot sites are shown; the decrease from the baseline (2001) is evident.

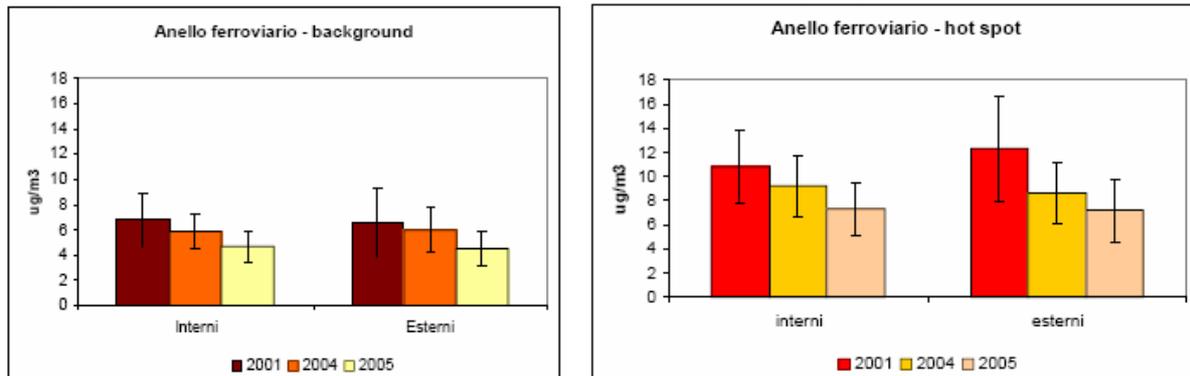


Figure 4 - Mean values of benzene concentrations (2001 – 2004 - 2005)

Moreover, Figure 5 provides the mapped benzene values of the passive sampler campaigns, carried out respectively in 2001 and 2003. The decrease in terms of concentrations is clearly appreciable.

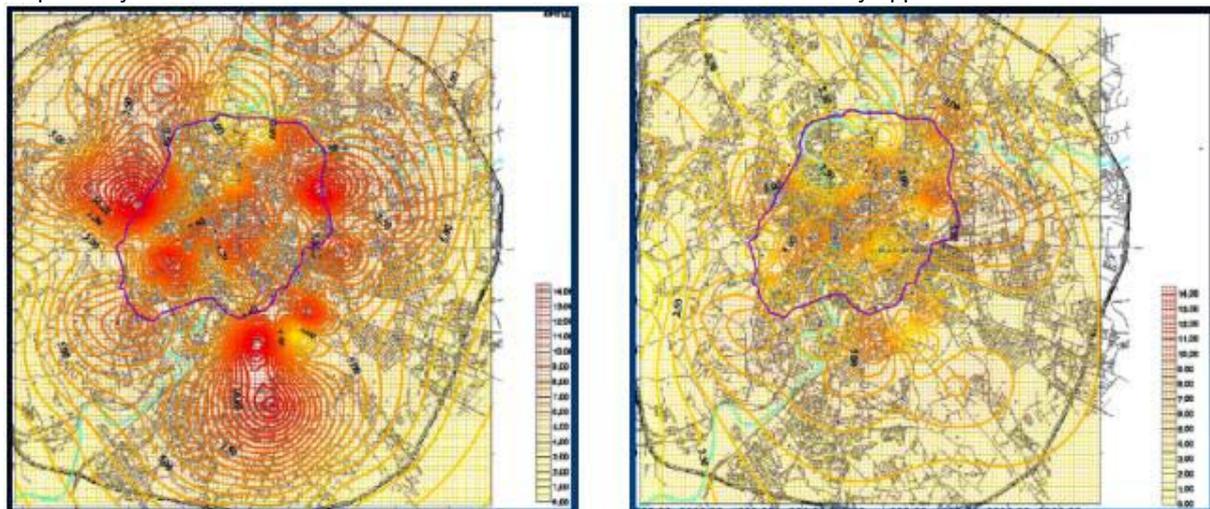


Figure 5 - Values of benzene concentrations (2001 – 2004) coming from passive sampler campaigns

Transport

The increase of trips at urban level (from 5,6 millions – baseline to 6,1 millions - ex-post value) according to ATAC database was not merely due to Miracles measures but it was linked to the urban development of Rome. Moreover, if the previous baseline is considered (1996), trips are about 6,4 millions, in agreements with the 2004 registered value, showing the expected decrease. Such data however can be better understood if linked to the analysis of the situation and of evolutions of the vehicular fleet in Rome during the MIRACLES Project period, which can contribute to explain also the changes of pollutants levels.

The vehicular fleet in Rome

Every year, ATAC and Rome Municipality verify the evolution of the vehicular fleet in Rome. This check is based on data available from Automotive Club of Italy (ACI) and specific surveys.

At the beginning of 2004, this fleet was composed as described in the following figures.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

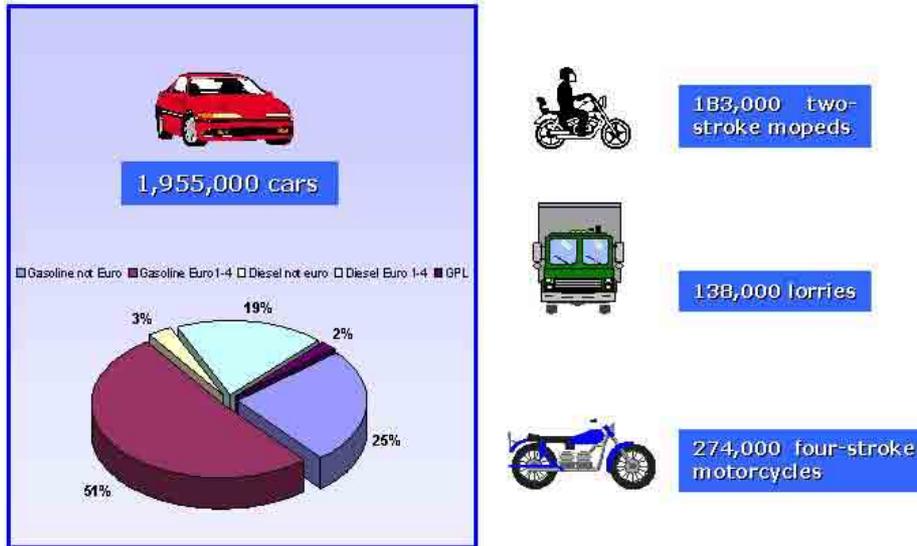


Figure 6 – Composition of private fleets circulating in Rome 31/12/2003

The effects of the policies relating to the prohibition of circulation to vehicles not meeting the Decree 91/441 and successive ones requirements, inside the Railway Ring, for what concerns the composition of the vehicular fleet are linked to:

a remarkable increment of diesel vehicles after 91/441, due to the commercial efforts made by the manufacturers, but with no positives results in terms of PM emissions reductions;

the changes of the commercial vehicles fleet in the 1999-2003 period (+ 15% , i.e. over 17.000 light vehicles and – 45%, i.e. minus 5.500 heavy vehicles).

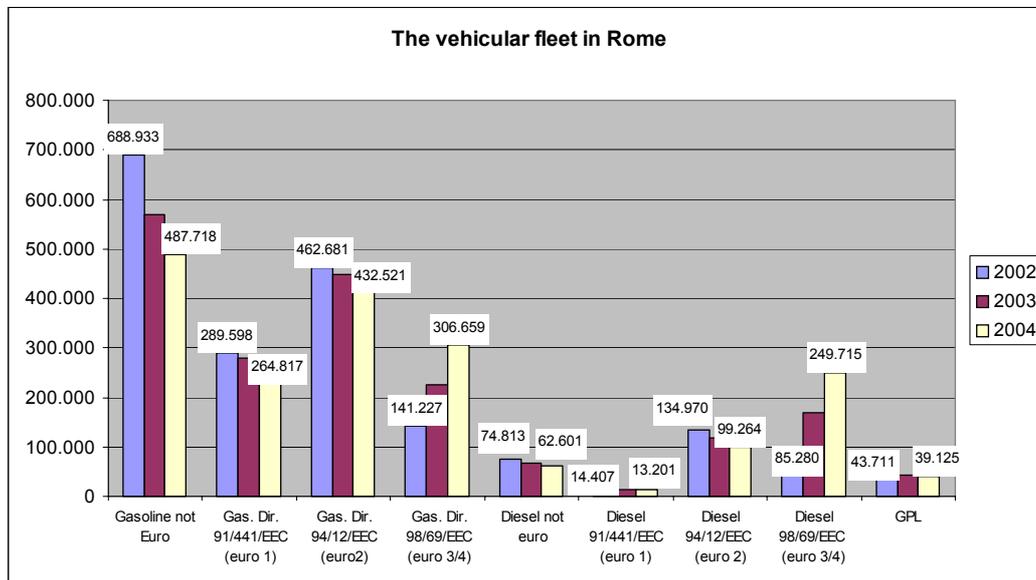


Figure 7 - Comparison between before (end 2001) and post (end 2003) of the vehicular fleet in Rome

The number of the motorcycles registered to the PRA – Public Register of Auto vehicles of Rome is considerably increased from 1999 to 2003 (+ 40%, + 110.000 units), according to an exponential trend rather than a linear one.

Such factors contribute to explain the impact of the access limitation to the whole Laboratory Area to not catalysed vehicles also in light of the analyses of detected traffic flows on predefined road links (see Figure 8), performed by ATAC, in four different campaigns (November 2001, February 2002, May 2002 e November 2002, according to each stage of the Rail Ring restriction policies implementation)

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

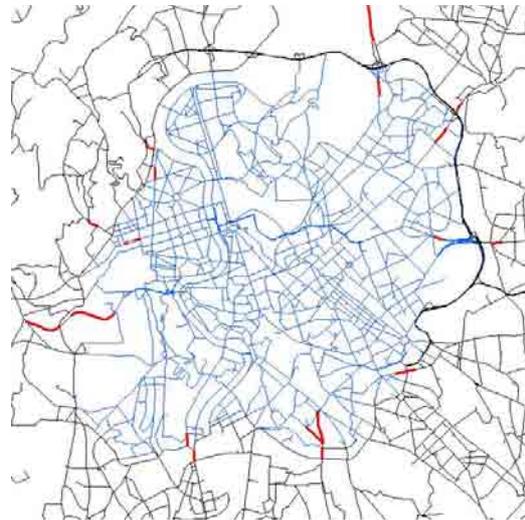


Figure 8 – Reference road link (red) analysed to assess the impact of the “Rail Ring “ access restriction

Such analyses, reported in the “Annual report on Rome’s air quality”, shows that the policy did not produce any significant change in terms of total number of circulating vehicles (and hence in terms of trips), whereas it generates a quite significant impact in terms of air pollution reduction, as described before. The situation could be described by “same traffic, less pollutant”.

For instance, spot surveys at eastern zones of the city recorded changes of daily traffic flows incoming of +11% and -3% respectively in November 2003 and November 2002, in contrast either to what detected at a Northeast zone of the city, in which no significant variations of daily traffic flows in the same period were recorded, or to the western zone of the city, in which were surveyed respectively variations of daily traffic flows of -10% and +3% between the monitoring survey of the same period.

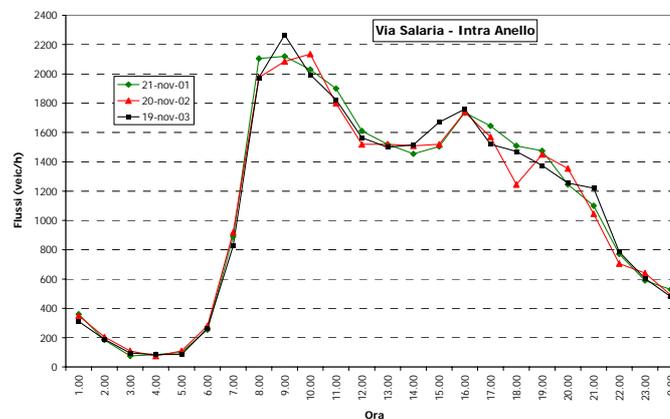


Figure 9: Analyses of flows in the Northeast zone before and after the Railway Ring limitation

In conclusion, the prohibition to the Railway Ring to not catalyzed cars therefore has not produced decrease in the levels of traffic flows accessing to the area, but it has induced to an acceleration in the renewal of the automotive vehicle fleet, an extremely important factor for the lessening of the air pollution levels and the renewal of the vehicles constructed with obsolete technologies.

In general, a total check on the main 173 counting system of the ATAC Traffic Control Center (about 200 km of primary road network of the city of Rome, mainly in the Laboratory Area) in the months of february and march of the years 2001-2005 is anyway evidencing a decrease trend of the total traffic flow from 2002, i.e. when the MIRACLES Package began to be visible: .

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

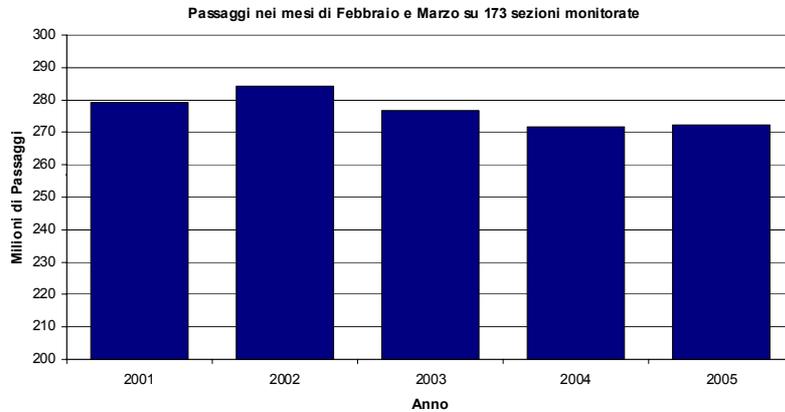


Figure 10: Trend of traffic flow in 173 main road sections in Rome, years 2001-2005. Absolute values

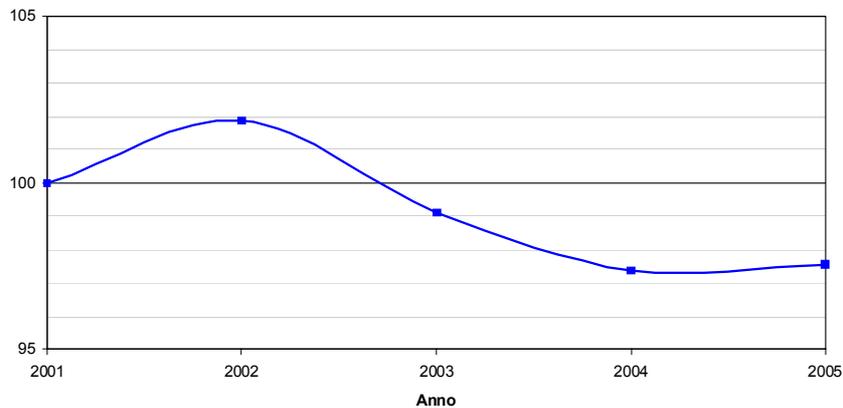


Figure 10: Trend of traffic flow in 173 main road sections in Rome, years 2001-2005. Percentage values

The Blue Tag

For what concerns the Blue Tag (“Bollino Blu”) implementation, Figure 10 shows the variation in years 2000 – 2004 of the number of controls carried out (blue tag) over the automotive vehicles circulating fleet according to typology of feeding. The increase of number of controls during MIRACLES is about 20%.

CARD	TYPE
B PETROL NOT CAT	B PETROL
	G LPG
C CATALYTIC	B PETROL
	H LPG
D DIESEL	A ASPIRED
	T TURBOCOMPRESSED

	N° controls "blue tag" on 4-wheels				
	2000	2001	2002	2003	2004
BB	361.75	269.94	128.56	99.166	96.759
BG	32.583	29.959	24.132	34.522	42.773
CB	419.72	618.95	416.95	530.00	761.86
CH	10.139	21.319	13.505	20.888	22.842
DA	1.961	1.303	952	1.000	933
DT	120.06	142.25	118.50	158.14	270.50
	946.22	1.083.73	702.61	843.72	1.195.67

fonte ACEA

Figure 10: Evolution of blue tag (“Bollino Blu”) controls on 4-wheels fleet in Rome during 2000-4

In the following figure is observed the variation of controls’ number carried out (blue tag) and the evolution of the circulating automotive vehicles park between the years 2004 -1999.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

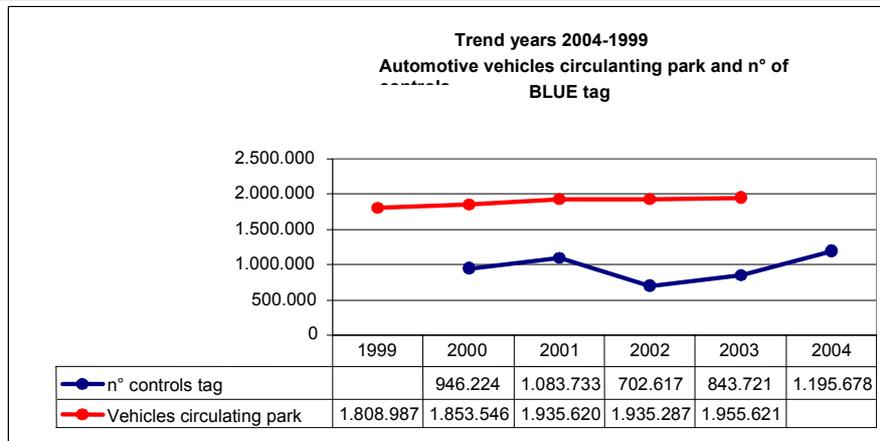


Figure 11 - Trend of n° of “blue tag” controls and the evolution of the automotive fleet between 2004-1999

For what concerns the Blue Tag application for 2-wheels, regarding the data checked during 2004 supplied from the ACEA, there is evidence that approximately 64% are not compliant with the Directive 97/24 CE of all the controls carried out (Table 2). Besides and considering the circulating fleet, the 50,000 two wheels controls carried out are covering only a limited part: therefore the measures must still enter in full force. This is expected by the end of 2006.

Emissions results	N° controls	
	Absolute values	Values %
Conformed 97/24	18.194	36 %
No conformed 97/24 – 2 strokes	20.447	41 %
No conformed 97/24 – 4 strokes	11.662	23 %
	50.333	100%

Table 2 - “blue tag” controls for 2-wheels in 2004

All results for ex-ante and ex-post scenarios, due to the implementation of the WP5 measures are synthesised in Table 1; for extra comments, see also the 5.1b template.

WP 5.1 clean zones								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.1.a	9	polluting vehicles (no of polluting vehicles)	1)868.72 2)441.11 3)64.796	a)465829 b)366923 c)1219910 d)101564 e)2536	a)39972 b)35686 c)16301 d)15833 e)2536	a)39783 b)35368 c)16380 d)15631 e)2573	1)550.319 2)242.140 3)42.435	The figure are referring to whole city and to: 1)Not cat cars; 2)Not cat 2-wheels; 3)Not cat comm. a)Gazoline car<1,4t b)Gazoline car>1,4t c)Diesel car <1,4 t d)Diesel car >1,4 t e)Buses
R5.1/Env.2.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.89 5	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R5.1/Env.2.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city

Table1- ex-ante and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

WP 5.1 clean zones								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.2.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R5.1/Env.3.a	5	concentrations of CO (millig/m ³)	1.77			No direct data available See table 2 on template	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stat) (***)
R5.1/Env.3.b	6	concentrations of particulates (microg/m ³)	50.0			on access restriction	44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***)
R5.1/Env.3.c		concentrations of C6H6 (microg/m ³)	1)8.75 2)12,3 LA-H 6,8 LA – B 8,6 C				1)5.55 2)7.2 LA-H 4.8 LA-B 5,2 C 4,9 TR 6,4 S	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***) 2) Measured value by passive samplers method (**)

(**) Mean normalised value of all the 51 monitored locations in the Rail Ring Area (12 at LTZ, 7 at Trastevere, 4 at San Lorenzo, 5 at Tridente)

(***) The values of Villa Ada ATACtions are not considered due to its use for the characterisation of the background air quality ATACtus of the city.

LA: Laboratory Area (H- Hot spot, B- background); C: ZTL, TR: Trastevere, S: San Lorenzo

Table1- ex-ante and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones (cont.)

WP 5.1 clean zones								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Tran.1.a	21/22	modal split (motorized and non motorized) (% of the total flow)	1) a)20 b)48 c)11 d)21 2) a)30 b)27 c)23 d)20	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 18 b) 47 c) 8 d) 27 2) a) 31 b) 22 c) 24 d) 23	1) whole city 2) Rail Ring Area a) PT b) Priv 4-wheels c) Priv 2-wheels d) Walking
R5.1/Tran.1.b	21/22	traffic levels (trips day per vehicle)	2,2	2,5	2,5	2,5	2,5	
R5.1/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42	1)4,8 2)1,53	1)4,8 2)1,53	1)4,9 2)1,55*	1)6,1 2)1,5	1)whole city 2)Rail Ring Area

Table1- ex-ante and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones

Status of the Measure beyond MIRACLES

The measure (including all the subtasks) is currently operative and will continue beyond MIRACLES

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1a – Measures at Laboratory Area level

City: Rome

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The City Administration has developed policies aimed at improving traffic mobility conditions, increasing road safety and decreasing traffic related pollution and in re-qualifying urban spaces, rationalising public space, safeguarding citizens' health and life quality, and preserving historical and architectural heritage.

To reach these objectives, the City Administration is trying to discourage the inbound traffic, attracted by the business functions locations. The strong attempt is to drive the City of Rome towards a Sustainable development, able to assure its economic growth and attractiveness.

The concerns for poor air quality in these years in Rome, with threshold limit values often not respected, are giving strength to the policies aiming to a re-balance of the modal split towards collective transport and restrictive measures to the private vehicles like the on-street parking pricing are more accepted than ever in Rome.

In this general framework, the limitation to access the city inner zones with the mostly polluting vehicles and the obligations to check every year the emissions of all the citizens vehicles, both 4 and 2-wheels, should enhance also the awareness of the Rome inhabitants itself, towards more sustainable behaviours

M13: Interrelationships with other measures

5.2 Set-up of new Pedestrian Areas

6.1 Pricing policies;

6.2 On-street parking Development;

7.2 Information -Awareness raising aspects of WP10 – WP3 and in particular the impact of highly polluting vehicles.

M14: Lessons learned

The right mixture of limiting measures, flexible solutions and technology supports must cope with the everyday problems. Every measure has to be evaluated before and need an experimental period where set-up all the particularity of the measure itself with all the involved actors and stakeholders.

The CIVITAS funding is to be confirmed as essential for the establishment of an innovative way of thinking, to partially support the engineering and demonstration work but also to cope with new problems in a common way across Europe.

Communication is fundamental to avoid that these measures are perceived by the citizens just like limitations or like an increased taxation on their work.

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Tel +39-06-46959469, e-mail: fabio.nussio@atac.roma.it

3. Measure 5.1b – Access Restrictions to the City Centre

MEASURE-LEVEL RESULTS	
Measure title: Set up of City Centre Clean Zone:	Project: MIRACLES
Measure number: 5.1b Access control systems in central areas	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Main objectives of the measure are: to improve traffic mobility conditions, increasing road safety and decreasing traffic related pollution, and to re-habilitate urban spaces, rationalizing public space, safeguarding citizens' health and life quality, and preserving historical and architectural heritage as well as to take advantage of ITS solutions for the AC purposes. All these goals are also shared by measure 5.2 "pedestrianization".</p> <p>The objectives of this task 5.1b are referred to the implementation of Limited Traffic Zones with the support of the ITS technologies as well as the optimisation of the whole ACS system in Rome.</p>	
M2: Measure description:	
<p>The "Set-up of city centre clean zone" is a multitask measure, characterised by a very complex iter, in which the access control on central areas is the main issue (the measure description has been subdivided into 5.1a and 5.1b).</p> <p>The measure is applied both to the wider Laboratory Area and to specific LTZ zones inside, with the aim of implementing policy measures to limit the access to private vehicles, with the support of ITS measures:</p> <ol style="list-style-type: none"> 1. Set-up of access control limitations in the whole Laboratory Area to allow entry to catalysed vehicles only; 2. Fleet pollution control to increase environmental performance of the allowed vehicles with the yearly check-up of vehicles emissions to be extended to compulsory servicing of two-wheel motorcycles and mopeds, 3. the closure of the Access Gate System – ACS to be completed and integrated through the installation of a new access gate in via Dei Fori Imperiali; 4. two access restriction trials at S.Lorenzo and Trastevere districts to be transformed into structural measures with integration of new Electronic Access Control System (E-ACS) 5. Extend the pedestrian mode in the Centre of Rome, mainly with the institution of "Tridente" pedestrian area and "LTZ A1" in the city centre, sometimes supported by the presence of mobile bollards. This part is discussed in Task 5.2 <p>The present template 5.1.b details implementation and results of measures 3 to 5, referring to the city centre LTZ or for a small zone (San Lorenzo or Trastevere district).</p> <p>The template 5.1.a has detailed implementation and results of measures 1 and 2 at Laboratory Area Level,</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The main objective of the City Council is to achieve an urban sustainable development by implementing mobility policies. The ultimate aim is to have a "Clean zone" in the city centre, where alternative sustainable transportation modes such as pedestrians are allowed and where pollution is minimised. ITS technologies are combined with policies to cover the whole Laboratory Area and specific Limited Traffic Zone (LTZ), especially under traffic pressure. It is probably the most extended access control management system in Europe, perhaps only comparable with the London Congestion Charging scheme, even with different rules.</p> <p>Consequently, the innovative added value of the City Centre Clean Zone of Rome is its strong integration and interrelation with the rest of the city, as well as the technologies used and the acceptance of the electronic instead of human control at any level, from stakeholders to citizens.</p>	
M4: Situation before CIVITAS:	
<p>The Limited Traffic Zone of the city centre was already partially equipped with an Automated Access Control System, including a flat flare RP (Road Pricing) scheme, in order to limit private vehicle access to the city historic centre. The system encompasses 22 electronic entrance gates, permitting fee-paying access and parking in the LTZ to residents and other categories of users (such disabled persons and doctors among others) through "On-Board Units", a tool based on smart-card technology. Anyway, the system started in October 2001 and, at the beginning of MIRACLES, a lot of tuning work was still to be carried out.</p> <p>In addition, there were no policies to limit traffic in the Trastevere and San Lorenzo districts.</p>	
M5: Design of the measure: Access Limitations in Central Zones	
<p>Fori Imperiali gate project.</p> <p>To ease the pressure of private vehicle traffic in the historic centre and encourage the use of public transport, a series of restrictive measures have gradually been introduced, the most important of which is undoubtedly the</p>	

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

Limited Traffic Zone (LTZ). As described in D2.1, a complicate and long process permitted to have the authorisation to automatically operate the electronic gate system, that started normal operation in October 2001.

The electronic system does not, however, cover the entrance gates in the area of Piazza Venezia, where the Municipal Police continue to manually check permits. The lack up to now of the access gate in Via dei Fori Imperiali is due to environmental impact problems linked to its implementation.



Figure 1 – The Fori Imperiali area

As shown in the previous figure (where the cordon and the surrounding electronic gates are also indicated), Via Dei Fori Imperiali is a fundamental node for the Central LTZ closure: with this gate the whole ancient Roman zone will be covered by the measure.

Differently from D2.1, where the preliminary project was based on a double-lane gate system, due to its position in a really complicated framework including the Roman heritage center, the Municipality and Mayor offices, located in fundamental axe of private and public transport, suffered during the whole Miracles project (last 4 years) of continuous changes. On the other hand, it is necessary to install it to “close” the e-gates system” in the city centre.

Now, a solution was found and the definitive project approved by all interested Bodies: the gate system will be installed in the current year (2006). The history of such sub-project demonstrates how the implementation of electronic gates in urban context is still a process far from standardisation and it is remaining an RTD activity.

In particular, the integration of a new access gate in via Dei Fori Imperiali last problem was that the gate needed to be removed every June 2nd, due to the necessity of having a military parade for the holiday of the Republic. On the other hand, the ministry of the infrastructure requires a testing period after each installation, i.e. every year, and this was unfeasible.

Besides, according to Italian legislation, the installation of electronic gates needs some platforms to reduce the carriageway and other complementary works, not compatible with its annual removal. Decision was to carry out a deeper final analysis through the use of a technical table including all the interested ministries, the cabinet of the Mayor and the technical experts, both from the Municipal department of mobility and from ATAC.

On December 20th, 2005 this technical table reached an agreement to move the gate behind, exactly in the crossing via Cavour – via Dei Fori Imperiali area; the new project was finalised and approved by all the competent Bodies. As a consequence, the control is presently carried out by Urban Police and the respect of the general ACS+RP scheme is continuous.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome



Figure 2:- Simulation of the new gate to be installed in Fori Imperiali and the interested area

The equipment, technology and SW configurations have to be compatible with those already in use in other access gates. The gate need to be equipped with appropriate horizontal and vertical traffic signs. The gate technology have to be based on a OCR (Optical Character Recognition) infrared camera to identify automatically the plates of vehicles and a TELEPASS Unit to enable the vehicles with On-Board Units (OBUs) for Rome LTZ to be identified, according to the requirements already outlined in D2.1.



Figure 3 - Fori Imperiali gate, pole with devices.

Trastevere Project.

The Historic Centre LTZ includes Trastevere Sector G. People getting to this area mainly non-residents using the many attractions in the area a primary pole of the evening and night-life free time of the city. Such characteristic gives elevated attractiveness of the traffic in the same period, reflected on the circulation of the zone that is congested during night, and especially in the week-ends, with problems in terms also of acoustic and atmospheric pollution.

The Municipality of Rome has set out a project integrating of two different kinds of control in the area:

- ❖ Access restriction in the hours between 21.00 and 03.00, controlled by access gates;
- ❖ Pedestrian areas in the sector to be safeguarded by bollards (special permits are provided to residents).
- ❖ The accesses to Trastevere, is now reduced to 9 strategic points, presently “manually” controlled by Urban Police according to Council Decision n. 222 dated April 20, 2004.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

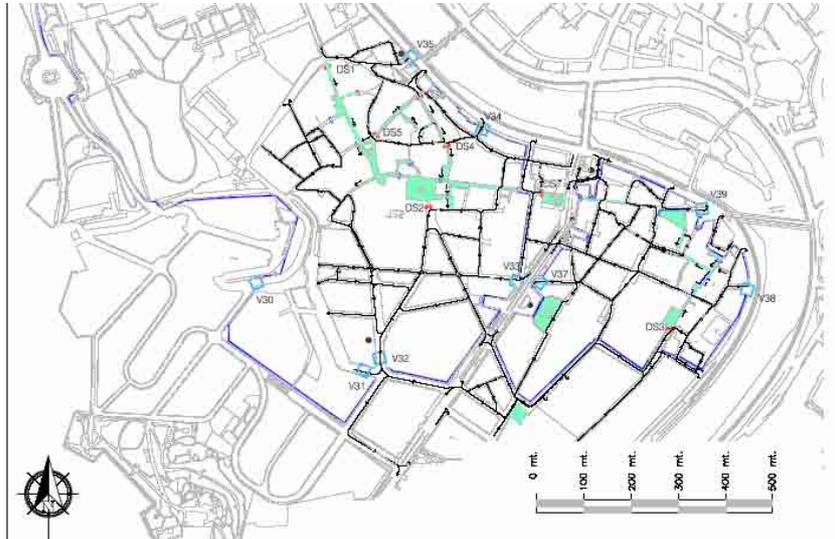


Figure 5 - Trastevere ACS Project: Circulation scheme in the area and pedestrian areas (green)

The simulation here reported and included in the approved project, respectively for Piazza Trilussa and via Cardinal Marmaggi gates (figures 6 and 7), provide an idea of the visual impact of the gates in some locations and where the use of the single pole is expected, in order to limit the impact and to be oriented towards a valorisation of the areas and pre-existing urban environment.



Figure 6 – Example of Trastevere ACS Project: Piazza Trilussa Area

In addition, the control centre located in ATAC, controlling all the electronic access gates, was upgraded to manage the increased number of access gates; plate recognition software will be fine-tuned to take into account the new arrangement of cameras.

San Lorenzo Project.

San Lorenzo neighbourhood as Trastevere is an area where mainly non-residents, attracted by the evening and night-life, are coming. Such characteristic gives elevated attractiveness of the traffic in the same period, reflected on the circulation of the zone that is congested during night, and especially in the week-ends, with problems in terms also of acoustic and atmospheric pollution.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

The Technical Offices of the 3rd District advanced a request to introduce a night-time LTZ. The Council Deliberation no. 107, 25/02/03, established San Lorenzo as a Limited Traffic Zone. This was followed by a trial period of night-time restricted access between May and October 2003. By the end of this trial period the president of the 3rd District, asked for Rome City Council to approve the night-time LTZ scheme in San Lorenzo. Request was also made to extend the area of the LTZ to other streets and to launch the electronic access control system.

The Limited Traffic Zone in San Lorenzo was once more operational as a trial from 1 December 2003 until 30 April 2004, from 20.00 to 03.00 on Fridays and Saturdays. Rome Administration definitively approved the San Lorenzo LTZ scheme with the Council Deliberation no. 316, 14/05/04.

In this definitive version the LTZ is operating with a summer timetable and a winter one: from 1 April to 31 October (excluding August) cars will not be allowed in from Wednesday to Saturday (20.00-03.00), while from 1 November to 30 March restrictions will operate on Fridays and Saturdays (20.00-03.00). Parking areas in the nearby are supervised and well. The shuttle service between the parking areas and the centre of San Lorenzo is operated with electric Bus "Nottambula by ATAC (ref to WP7 – task 7.3).

The electronic control system is to be installed at the 7 original access gates expected in act n° 107/03, shown in the following Figure.



Figure 7 – San Lorenzo Project: the area and the location of the electronic gates

The same requirements of Trastevere ACS Project were used, considering the similar use of the system to be carried out in these two "leisure districts".

In the following it is reported the simulation for a gate, completely similar to the ones for Trastevere Project.

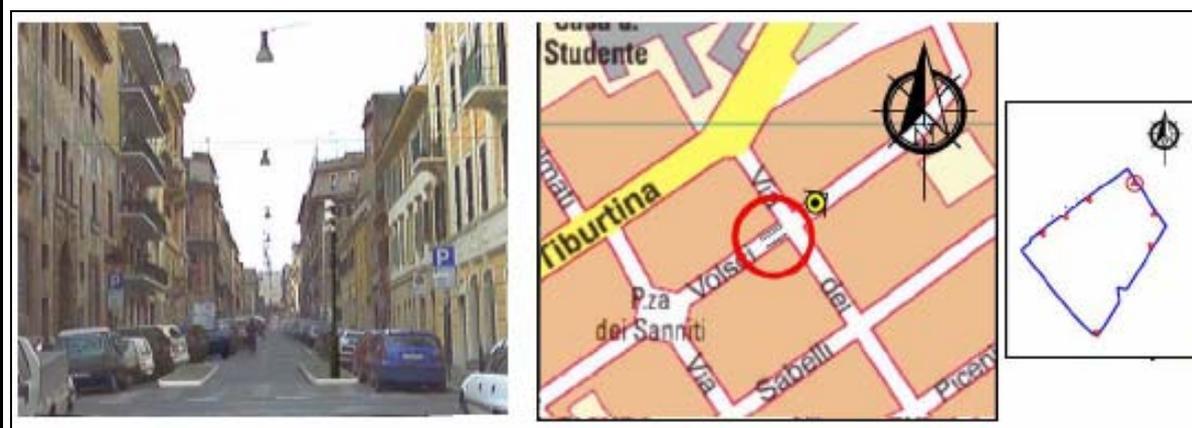


Figure 8 – Example of San Lorenzo Project, simulation of ACS systems

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

Optimization of ACS systems

This task includes the complete adjustment of the whole ACS central system, in order to support the different ACS sub-systems and different procedures across the city center. Different databases were already created with the different white lists of authorized people and for the storage of different violation. Also the back-office procedures and fines emission process were completely realigned.

In particular, attention is dedicated to the human interface where to deal with images of the plates in potential violation, in order to confirm it or not by the policeman: a web application is presently under testing with new functionalities to support the operator in its plate analysis, evidencing where are uncertainty in the OCR reading as well as to recover recursive errors. In the next figure a screenshot of the new interface is taken, evidencing some new facility, including the possibility of detecting motorcycle plates in specific cases.



Figure9: New interface of the ACS+RP management system

Besides, analysis of the efficiency of the ACS has pointed up the high number of penalties incurred by unauthorized vehicles entering the LTZ during the off-limits period, about 8% of the average daily number of vehicles, amounting to several thousand per day. Penalties have been observed to peak in two situations in particular, i.e. In the period prior to re-opening the LTZ in the evening and when the ATACndard timing is changed (for example, over the Christmas period, when the area was also closed to unauthorized traffic on Saturday and Sunday mornings). Heavy media coverage and variable message signs seemed to have little effect.

The present vertical signal, shown in Figures 10, is in compliance with the prescription of the Ministry of Infrastructures, competent for installations on road of control and regulation of the traffic. On the other hand it adapted with difficulty to situations of change of the rules, simply possible to put into effect with technological devices. It was decided to use a small VMS with simple, but clear messages. In the new installations it will be integrated in the gate infrastructure or directly in the poles as shown in the second picture.

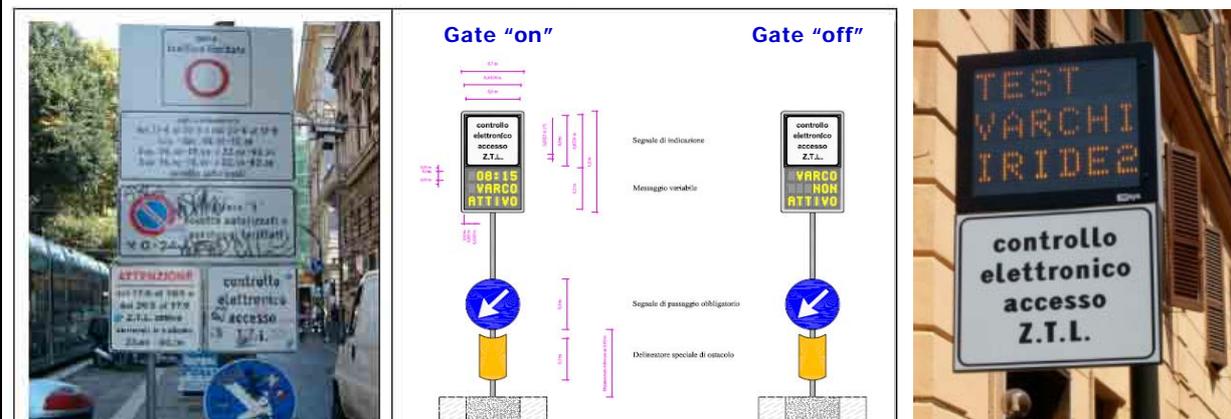


Figure 10 – New vertical signals for all the e-gates project in MIRACLES: design and real implementation

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M6: Actual implementation:

The history of the Access Control System and Road Pricing scheme in the Rome City Centre started with the ACS+RP system developed in PRoGRESS Project in the city central LTZ. This system is proving to be a very effective demand management policy and can be considered a success story, demonstrating that a mixture of access control and pricing can give high flexibility to policy implementation.

At the beginning of MIRACLES Project (year 2001), a complex financing plan was settled out with the involvement of the Municipality and the Ministry for the Environment: the plan included also the exit gates to set-up other pricing policies in the city centre. According to the results of the real use of the system and simulations carried out during the PRoGRESS Project (see task 6.1) and with the aim to give an answer to the problems arising from the implementation of the ACS+RP scheme in the Central LTZ, a complete revision of the project was necessary.

The proposal to set up new systems in Trastevere and San Lorenzo District as well as to install the access gate system in Fori Imperiali – Piazza Venezia was approved by the Municipal Council with the decision n. 7188/2003 issued in April 1st, 2004. A new project (RESCACOR-ZTL) including the three sub-projects was sent to the Italian Environment Ministry, partially co-financing the plan, in July 2003.

Municipality received comments from the Ministry in December 2003 and finalised the preliminary project in January 2004. After another comments and answers period, the Ministry approved the Project with its Decree n° DEC/DSA/2004/01253 dated 14/12/04. In the meantime, the Rome Administration emitted all the necessary acts to set-up the zones and their limitation, where the control is presently made by urban police. Now, the operational phase of this RESCACOR-ZTL Project was assigned to ATAC, now ATAC, and the implementation work is ongoing.

Specific issues for each sub-project are reported in the following

Fori Imperiali gate project.

The decision on the two final solutions detailed in the previous item was defined end of 2005. The implementation work plan expect to set-up the gate within 2006. Notwithstanding, the control is presently carried out by Urban Police and the respect of the general ACS+RP scheme is continuous.

Trastevere Project.

The ACS scheme was put into operation in experimental way from May 19th until October 9th, 2004 (excluding August), with the traffic limitation operational four days a week, from Wednesdays to Saturdays, (21 pm – 3 am). With Council Act n° 661 dated October 6, 2004 the experiment was considered successful and it will continue on a regular basis on Fridays and Saturdays in the same night period. Besides, it gives “green flag” to the implementation of electronic gates”. The Council act n.222 dated April 20, 2004 definitively gives the limits of the zone and the exact position of the access gates.

At the same time, the definitive project of the electronic-ACS was completed by ATAC and approved by the Municipality Mobility May 19, 2005.

In October 2006 the technology provider was selected. The installation of the gate system was completed in March 2006. The support of the electric bus lines “nottambula” is already operating with the line n. 125

Besides, an extension of the Limited Traffic Zone was approved by the Municipality during this reporting period and the E-ACS was increased with two new gates to control also the extended area. The electronic system includes access gates with an Automatic Number Plate Recognition (ANPR) system and integration with a new gates road signalling system. The system will enter into routinary operation in the week-end nights as expected, but the Municipality extended the ACS scheme also to **morning hours, from 6,30 to 10,00**.

The installation of the electronic gates, the road signalling system and the system server for Trastevere district was completed in March 2006. The start was fixed for the 28th of July, while the testing period was operated in June and July '06.

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Figure 11: The new parking area in Trastevere district

At the same time, ATAC completed and opened a new public parking area with about 220 parking places, close to the district. ATAC besides put the standing area of the electric bus n. 125, line "nottambula" serving the district just in front of this parking area.

San Lorenzo Project.

Rome Administration definitively approved the San Lorenzo LTZ scheme with the Council Deliberation no. 316, 14/05/04, confirming San Lorenzo as a Limited Traffic Zone as established by Council Deliberation no. 107, 25/02/03, and the boundaries there defined;

At the same time, the definitive project of the electronic-ACS system, now completed by ATAC, was delivered by Rome municipality to the co-financing Ministry on October 25th, 2005.

Implementation will be carried out after the tender selection of the technology provider, currently (may 2006) in progress. The workplan expects to complete the installation and setting-up of the system within 3/2007. In parallel, the continuous application of the experimental ACS scheme is operating with the bus electric line "nottambula" n. 141.

Optimisation of ACS system.

The plan for the new E-ACS systems expects also an integration and function optimisation among them. Besides, a new dynamic signalling system is expected in each gate, in order to inform the citizens on the ATACus of each gate (active/not). This activity will be included in each subtask regarding the gates while, for what regard the integration of pre-signalling VMS in the existing gates, it will be carried out within 2006/7.

M7: Deviations from the plan:

The delayed approval of the RESCACOR project, partially co-financed by Ministry of Environment, arrived just in December 2004, created delays in the further implementation of the Access Restrictions systems enclosed in this sub-task.

The Municipality anyway decided in January 2005, before receiving the formal approval of RESCACOR-ZTL Project by the Ministry, to speed-up the process using its co-financing funds for the infrastructures, giving priority to the implementation of E-ACS in Trastevere District and to the general optimization of the E-ACS systems to be immediately implemented. The relevant projects were immediately finalized by STA (now ATAC) and approved by the Municipality, as already mentioned.

The other subtask (E-ACS for Fori Imperiali and for San Lorenzo) were restarted when the Decree arrived in Municipality. Due to MIRACLES work, the delay was anyway limited and the Municipal acts as well as the preliminary projects were already prepared. In this way, the general delay is limited to some months, even if the initial program was really ambitious and with some difficulties in practical implementation.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For both measures 5.1a and 5.1b deviations occurred to the following indicators:

Evaluation category: *Energy*

- *Energy efficiency per transport mode*: added, due to the ITEMS application

- *Vehicle fuel efficiency*: added, due to the ITEMS application

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Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: removed because such costs were already included in the “cost for operating” indicator

Evaluation category: *Transport*

- *Average Speed*: removed because inside the zone pedestrian mode need to be favoured and thus this indicator is not suitable. In the border, no main changes were registered after the activation of the LTZs.

Evaluation category: *Society*

- *Crime rates*: removed; the indicator was not useful, because it was very difficult to assess whether any MIRACLES measure, or a cluster of them, could be reasonably linked to any variation of security. The reason relied on the matter that this kind of information is often merely quantitative and doesn't take into account the personal perception of security, felt by the users. Moreover, data are usually underestimated since, very often, most of occurred crimes are not officially reported because of the nature of the attack (very small offences, as pick-pockets on buses), of the absence of someone to report to, of not confidence that the offender will be caught, etc.

- *Type and no. of provisions for disabled people*: moved to measure 7.2.1 because more suitable to describe it.

- *Acceptance*: merged into the “satisfaction level” indicator

- *Use motivation*: merged into the “satisfaction level” indicator

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Given the high number of indicators several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.

Environment indicators

For methods of measurements concerning emissions and concentrations, please see “Emission indicators” at section M8 of template 5.1a.

For what concerns the noise levels, since the enforcement on the law about the noise pollution is very recent, the collection of quantitative data on noise was possible only on few spots; for the measure 5.1, surveys were run at the S. Lorenzo area. Spot measurements were run on a 30 minutes basis, and repeated several times during the weeks. Measurement devices were Class 1 phonometers, located 1,5 m above the ground level and 1 meter far from reflecting surfaces.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Transport Indicators

For methods of measurements concerning changes of traffic, of parking and of the Public Transport service, please see “Transport Indicators” at section M8 of template 5.1a.

For what concerns the Miracles scenario, applied strictly to 5.1b measures, transport indicators were defined applying a model methodology. To model correctly user behaviors before and after the introduction of the measure, existing data coming from other projects were used to simulate the impacts of the assessed measures. To simulate access restrictions results, two O/D matrices, representing authorised and not authorised car users trips and access rules to LTZ, were considered. The model was based on user equilibrium multi-class (i.e. the two classes authorised and not authorised car users) assignment procedures, where travel time of each link in the network was calculated iteratively with specific link performance functions. The private transport graphs and the O/D matrices were supplied by ATAC and elaborated by DITS.

The MIRACLES scenario supply model: - For the supply model the whole Rome urban was taken into account. The network was based on a graph of 4861 links and 3367 nodes. The link performance functions used in the model

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were in BPR (Bureau of Public Roads) formulation, where travel time on a link is a function of the link capacity and the traffic condition, i.e. the number of vehicles traveling on the link.

The *MIRACLES scenario* demand model: - The used model was based on a subdivision of Rome urban area in 495 traffic zones corresponding to 495 centroids. In the simulations, the most recent available O/D matrices were used.

For ACS simulations four modal O/D matrices, estimated by ATAC, representing trips in the period from 21:00 to 22:00 were used. These four matrices were related to four modal alternatives: car (A), public transport (TP), motorcycle/moped (M) and walking (W). The number of non resident authorised car users was estimated as 25% of total accessing vehicles. This percentage was calculated on the basis of a survey on the number of commercial facilities in S. Lorenzo and Trastevere areas. In Tridente simulations, the morning peak hour was taken into account.

Other indicators

For what concerns the ex ante phase, Economy Indicators came from the UITP Millennium Database, whereas there were no data useful to describe directly the baseline situation of the energy indicators, but those ones elaborated thanks to the ITEMS exercise. Ex post measurements were provided directly by local partners, as recorded by companies databases.

M9: Achievement of quantifiable targets:

In summary quantifiable targets are:

- ❖ Reduce transport related emissions in the LTZ by 5%
- ❖ Reduce peak hours car traffic by 3% in the whole Demonstration Area;
- ❖ Reduce the number of polluting vehicles by 10% in the Demonstration Area;
- ❖ Reduce not authorised entrances by 30% in the LTZ, S. Lorenzo and Trastevere;
- ❖ Increase walking by 5% in the Laboratory Area;
- ❖ Reduce private peak traffic flows by 4% in the LTZ;

Synthesised actual results:

1. CO emissions values reduced by about 76%, particulate and C6H6 emissions values, reduced by about 38%.
2. Traffic flows in Laboratory decreased by 5% daily, (2001-2005), but the trend is to be monitored because during peak hours still congestion phenomena occur -
3. The number of non-catalysed vehicles e.g. non-catalysed mopeds reduced by about 45%, private cars by 37% and commercial vehicles by less than 35%.
4. Traffic flows accesses at S. Lorenzo and Trastevere decreased more than 50% - In Central LTZ the illegal entrances were 15% of the traffic total flow end 2001. End of 2005, they are about 7-8%, i.e. 50% reduction
5. Inside the Laboratory Area it has been recorded a 5% decrease in the use of private cars in favour of walking 3% and transit 1%.
6. Reduced by 20% during the whole restriction period and by 15% in the morning peak hour (8.30-9.30).

M10: Achievement of evaluation-related milestones:

The evaluation process was affected by some minor delays in the provision of ex post values of some indicators because of the complexity of the implementation process listed below; however this did not affected the edition of Deliverable 4.2.

M1: installation of access gates for Fori Imperiali: expected in year 2003, electronic gate installation delayed end of the project;

The manual control in this gate is performed since the beginning of MIRACLES by the Urban Police. The installations of the ITS device was delayed because this sub-task is linked to the extension of the electronic access gates in city center as already explained. As described in item M7, MIRACLES supported anyway the finalization of design and authorization work, permitting now a partial time recovery. Besides, the Urban Police control was reinforced and used also to have a manned gate for special cases (particularly for disabled people coming from outside Rome).

M2: regulatory action from Municipality to limit access of pollutant vehicles in Laboratory Area : year 2002/3;

All the necessary Acts from Municipality were emitted: Blue Sticker is now mandatory for all vehicles, including two-wheels vehicles and the Rail Ring is not allowed to not-catalyzed cars. Plan are now under discussion to enlarge the zone. Benefit in Air Quality condition are absolutely positive.

M3: extension of ACS to Trastevere area: year 2003/4;

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The necessary Acts were emitted by the Municipality and an experimental period was carried out before entering in the final configuration. Besides, the Municipality decided to install new electronic ACS system in the district, obtaining a co-financing by Environmental Ministry. ATAC supported the Administration in all the phases of the work, from permit definition and emission, white list management, road vertical and horizontal signalling, design of the E-ACS system. Besides, during the project were also defined and implemented a new extension of electronic ACS to San Lorenzo District with the same activity already described for Trastevere District. More, an integration with supporting measure for this new ACSs (new parking structure, new electric bus lines was implemented and it is presently working. (refer to Task 7.3)

In general, the set-up new clean zones with electronic gates need a complex series of actions: the process to be carried out is composed by many steps to be completed, as detailed in the following table.

Step	Action	Status			
		T	S	F	O
	<i>Project</i>				
Step1	Design of the project idea;	OK	OK	OK	OK
Step2	Official issue of the temporary policy (municipality deliberation/act/ decision) ;	OK	OK	OK	OK
Step3	Temporary testing (i.e. access restriction without electronic gates);	OK	OK	OK	OK
Step4	Official issue of the final policy (municipality deliberation/act/ decision);	OK	OK	OK	OK
Step5	Technological implementation of electronic gates	OK	On going	On going	On going
Step6	Achievement of the authorisation to operate the zone with remote access control system	OK	12/06	Not needed	Not needed
Step7	Communication campaign and Official Start of the automatic system	July 28 th , 2006	2/07	Not needed	Not needed

Where T= Trastevere district, S= San Lorenzo district, F= Fori Imperiali gate system, O= ACS optimization

Table 1 – Simplified list of the interventions to set-up LTS and electronic gates

The table above shows that at present all the steps preliminary to the final technological implementation of the measures have been performed and **in all the involved areas the LTZ is a structural policy.**

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) General outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) General Outcomes

All results for ex-ante and ex-post situations, according to the evaluation categories and selected indicators are reported in Table 1 and hereinafter commented in paragraph a.1 for what concerns the city central area and in paragraph a.2 for the Trastevere and S. Lorenzo implementations. In particular, in Table 1, the "ex post value" column provides actual indicators results which will be compared to the measure objectives.

a.1) The Access control system in the central area

Indicators listed in Table 1 show the variation of the situation before and after the implementation of the measures for the following evaluation categories: Environment, Transport, Society, Economy and Energy.

Environment

The environmental situation has been assessed according to indicators on pollutants' concentrations, emissions, noise level and the number of polluting vehicles. They were aimed at mainly assessing the achievement of two main measure general objectives as i) To reduce the impact of traffic on the environment and ii) To reduce the number of pollutant and poorly maintained vehicles in the study area.

The most important finding was that an appreciable reduction in air pollution was measured. As already started apropos of 5.1a.measures, the comparison, in terms of concentrations, between the annual mean values, recorded in 2001 (Baseline) and the mean values in 2004 (ex post evaluation) showed a reduction of CO concentration of about 21%, PM10 of 11% and Benzene of 37%.

In particular, results concerning benzene concentrations seem to be particularly relevant since, if just the last year is considered, a 27% decrease was recorded at about 50 sites.

Also emissions strongly decreased: CO emissions values reduced by about 76%, during both the peak and off-peak

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times of the day. For particulates and C6H6 emissions values, the reduction was about 38%.

Such good achievements exceeded expectations, as estimated both in the do-nothing and in the Miracle scenarios (for the latter, see details in the dedicated paragraph, at the end of this section). However, it is worth noticing that forecasts achieved by the application of the ITEMS model seem particularly unrealistic; indeed the reduction esteemed by the do-nothing scenario, i.e. without the implementation of the measure, (according to the ITEMS baseline) is about 40%.

Eventually, for what concerns the number of polluting vehicles, values achieved in the ex-post phase showed a reduction in the number of non-catalysed vehicles e.g. non-catalysed mopeds reduced by about 45%, private cars by 37% and commercial vehicles by less than 35%.

However, it is sensible to consider all such good results not as an effect due to the implementation of just one single measure of WP5, but rather due to all the measures adopted in the Miracles project, in which measures of WP5 played the main role. For instance, it must be underlined that a main effect was due to the measures linked to the circulation ban for diesel and gasoline fuelled vehicles not meeting Directive 91/441/CE requirements, in force since January, the 1° 2002 in the Rail Ring area.

Society

For this measure Awareness and Satisfaction indicators were available both for Baseline and ex-post measurements. The Awareness indicator did not show appreciable variations, whereas the Satisfaction level indicator dropped from 3,88 to 3,27 points of a 1-5 Lickert scale.

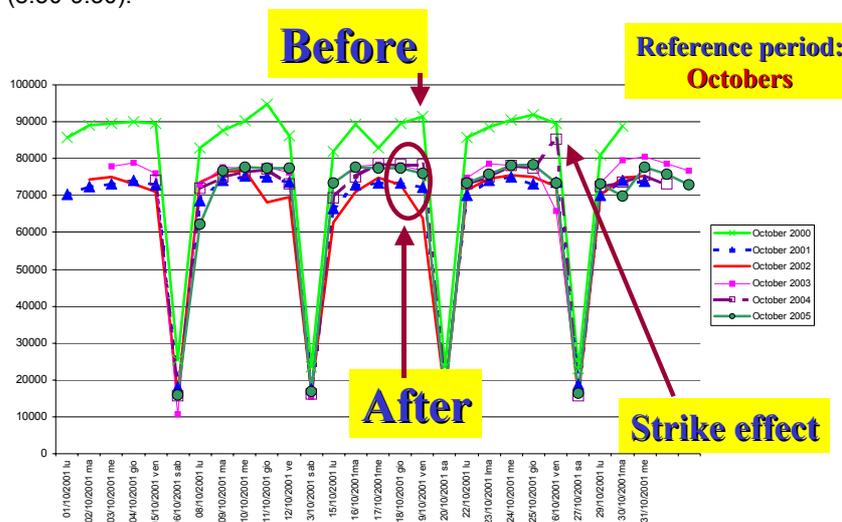
If such results are compared to one of the measure main goal, which is "to increase the level of protection of the city centre" thanks to the implementation of restrictive measures as for instance the access control system, such citizens' poor appreciation means that these measures should be "advertised" with more emphasis on the advantages achievable for everyone, especially in terms of environmental benefits and accessibility.

Transport

Trips at overall urban level were, in baseline 5,6 millions and in ex-post phase are 6,1 millions, according to the ATAC database. This fact probably was not due merely to Miracles measures but it was linked to the urban development of Rome. Besides, the baseline was referred to 1999, a special pre-Jubilee year. The previous baseline (1996) showed a total trips figure of 6,4 millions, in agreement with the 2004 registered value. These seem to be apparently contrasting results to interpret if not linked to the analysis of changes in modal split.

In general, modal split was influenced by all the Miracles measures, but WP5 Measures (and namely the Access Control system) played major roles, as already stressed apropos of the environmental issues. If before and after data are compared modal split in 2002 was: 30% transit, 27% private cars, 23% motorbikes/mopeds and 20% pedestrians. The 2005 data revealed that these proportions had switched to 31%, 22%, 24% and 23%, respectively. The most important result is the five point decrease (percentage) for private cars in favour of three point increase (percentage) for walking, thus suggesting that citizens reduced their use of the car for trips of short distances.

The benefit of the Access Restriction is also evident when traffic flows and illegal through-traffic phenomena are considered: the former decreased by 20% during the restriction periods (see Figure 13) and 15% decrease in the morning peak hour (8.30-9.30).



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Figure 13 - Comparison between before (year 2000) and post (years 2001-5) of the central LTZ scheme

and the latter reduced the proportion of illegal accesses from 18% to less than 10% of the total traffic flows (see Figure 14), during the four year of the gates implementation (even though, currently, still about 20.000 vehicles/week illegally access the area).

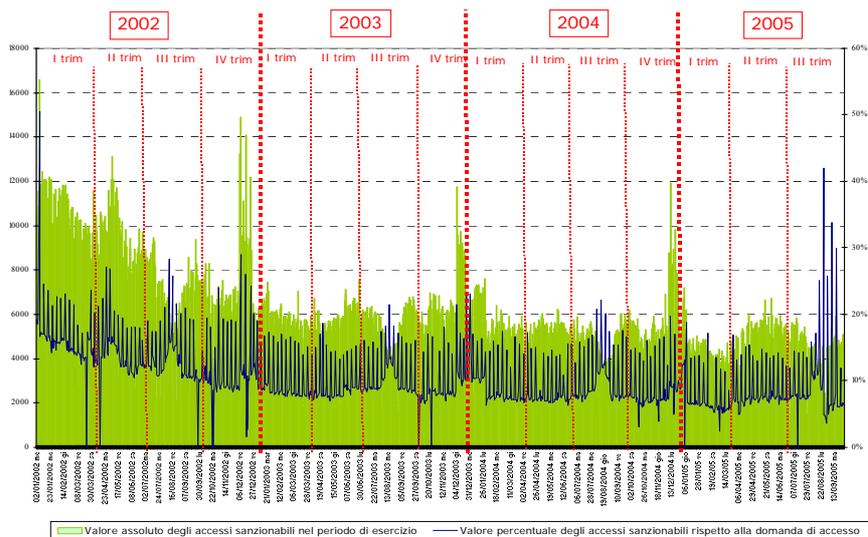


Figure 14 – Trend of the fines for access violation during Miracles project

Hence, general objectives as the reduction of the impact of traffic on the environment along with the increase of the level of protection of the city centre can be considered achieved, also if the benefits coming from the increase of the transit supply are considered; indeed transit strongly increased in terms of travelled people and of supply; it is also to stress the greatly improved journey time, which became virtually the half in comparison to the baseline time, and probably because of the improved traffic conditions (see Table 1 for the related indicators).

Energy

Even though there are no direct objectives linked to the improvement of the energetic situation, both the indicators “Energy efficiency of transport modes” and “Vehicle fuel efficiency” showed strong decrease which was due to the improved modal split, in which transit and walking increased, and to the reduced number of circulating polluting vehicles; the latter due to the renewal of the private cars fleet, also as a consequence of national funding to incentive less polluting vehicles. However, it is also worth noticing that such decrease goes in hand with a descending trend for what concerns fuel consumption, observed by ATAC since 1999.

It is impossible, anyway to individuate the contribution of each single measure to such results. Thus, the very strong reduction for what concerns the “Vehicle Fuel Efficiency”, which is virtually the half of what assessed as baseline value, and the appreciable decrease of “Energy efficiency of transport modes”, about 17%, can be considered only as general results.

Economy

Also in this case there are no direct objectives linked to the economy situation and even a comparison with the baseline is not fully appropriate for operating and maintenance costs for what concerns the measures of WP 5; indeed before their implementation only costs related to the whole urban transportation system were available, whereas after the implementation of the measures the single costs due to the implementation itself were at disposal. This explains why the two sets of values reported in Table 1 differ so much.

a.2) The Access control system at Trastevere and S. Lorenzo districts

The last general objective, i.e. the implementation of new access control systems both at Trastevere and at S. Lorenzo districts, still aimed at reducing the impact of traffic on both the local environments and at increasing the level of protection of these two neighbourhoods, seemed to be achievable since the creation of the Miracles scenarios. Indeed, in the scenarios both in Trastevere and in S. Lorenzo Areas increases in PT, walking and moped shift and a reduction of private cars were forecast (see *a.2 The Miracles Scenarios* for details).

Surveys made in September 2005 show that the scenario analyses were confirmed by real data on vehicle passages.

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a. 2.1) San Lorenzo ACS simulation scenarios

From the end of 2003 the LTZ was extended to S. Lorenzo district. The San Lorenzo LTZ is a 2,4 km² area limited by viale Scalo di San Lorenzo, via di Porta Labicana, via Tiburtina and via dei Reti.

In order to verify flows distribution on the network, the simulation of two scenarios was performed: "with" and "without" the measure. Both simulation scenarios were referred to the period from 21:00 to 22:00, when the historical centre LTZ was not operative. The O/D matrix used in simulation was related to private vehicle trips (auto).

In the "without" scenario, all streets could be travelled. In the second scenario, the San Lorenzo ACS became operational and a modal split for trips ending in the area was estimated.

Besides auto, moped, public transport and walking, a fifth modal alternatives was taken into account. This alternative referred to users who did not want to modify their destination and reach first S. Lorenzo boundary by car, than the inner LTZ by feet, after parking their vehicles in the surrounding parking lots of piazzale Verano or largo Settimo Passamonti.

The simulation results

Table 2 shows the modal split variation of trips accessing the area with and without access restrictions. The reduction in the number of users that reach the LTZ by car was apparent.

The simulation results are shown in Figure 15 ("with" access restriction), which illustrates results for eight road sections, four inside and four outside the LTZ.

In Figure 15, San Lorenzo LTZ is shown as a grey filled area, and traffic flows with variable link widths on the basis of hour traffic intensity.

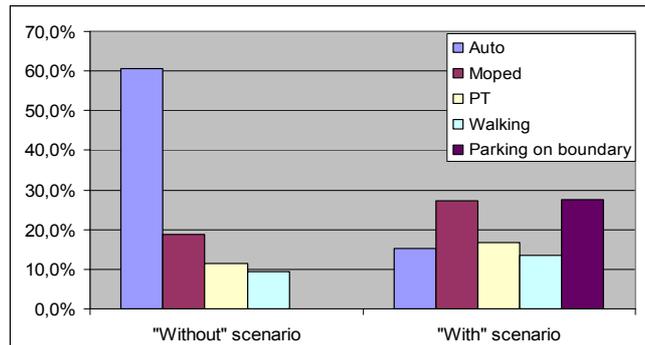


Table 2 - Modal split of trips to S. Lorenzo without and with access restrictions

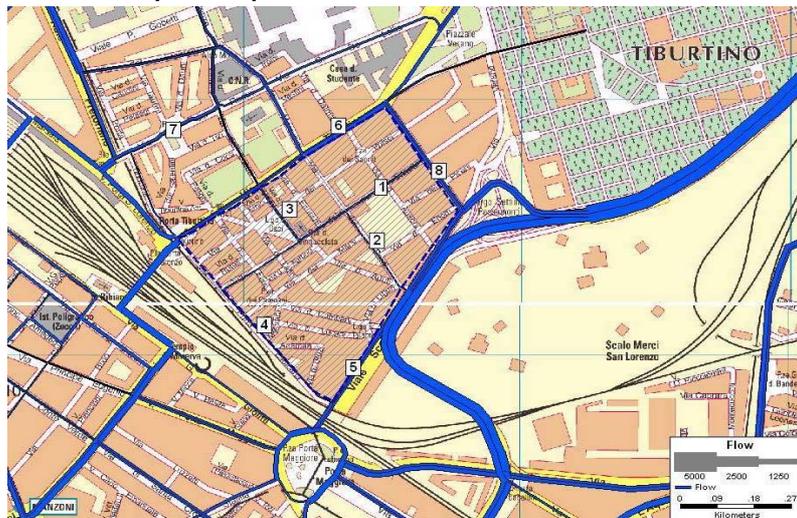


Figure 15 – Traffic flows in S. Lorenzo with access restriction

The analysis of the results shows that, in percentage terms, the traffic flow reduction inside the S. Lorenzo LTZ is

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more significant than the traffic flow increase in the surrounding area.

Impacts in terms of emissions and accidents were calculated using the TEE software. With reference to simulated period, the expected percentage variation of environmental (CO, VOC, NO_x, CO₂, PM) and safety (KSI) impact, for the whole city, are shown in Table 3. The calculation was made using the vehicle-km variation (for different modes) due to the introduction of the measure.

Since simulations referred to the whole city of Rome, no significant changes were remarked. The increase of KSI factor (Killed and Seriously Injured) was due to the shift of some car users to mopeds, being the latter much more dangerous than car. With regard to emissions, the increase of CO and VOC was due to the contribution of moped use increase, whereas the decrease of NO_x, CO₂ and PM was due to the contribution of car use decrease.

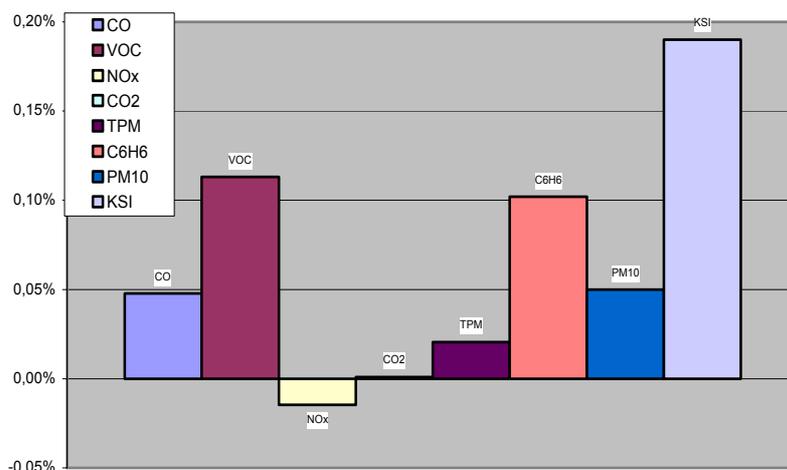


Table 3 - Percentage variation of impacts

a.2.2) Trastevere ACS. The simulation scenarios

In May 7th 2004, the access restrictions measure was implemented also in Trastevere district.

Trastevere includes an area of about 8,8 km² that is over three times larger than S. Lorenzo district. A road, called "viale Trastevere", crosses the district and divides the area in two zones.

A "without" and a "with" scenarios were taken into account, and simulations in 21:00 – 22:00 period were carried out for private vehicles.

In the "without" scenario all streets in the area could be travelled in the reference period.

In the "with" scenario, streets inside the area could be travelled only by mopeds, public transport and car users with permit. Due to the lack of data, a modal split for trips ending in the area was estimated, considering non authorised car users shifting to others modes proportionally to the "without" scenario shares.

It's supposed that, alike S. Lorenzo simulation, not authorised drivers left their vehicles in parking lots near the area, i.e. Parking Gianicolo (in the north of the area) and parking near piazza Porta Portese (in the south-east of Trastevere). This hypothesis was supported by the choice of Atac, VII Department of Rome Municipality and Parking Gianicolo administration to reward "toll free" who leaves his car in parking facilities near Trastevere

The simulation results

As it can be seen in Table 4, in the "without" scenario most people arriving to Trastevere used private cars (58%). In the "with" scenario, a strong increase of moped and "parking on boundary" alternatives can be observed: some 37% of users choose moped alternative, while some 25% choose parking on boundary.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

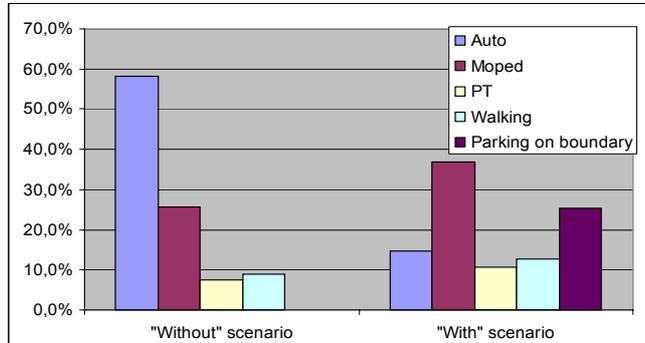


Table 4 – Modal split of trips to Trastevere without and with access restrictions

In Figure 16 (“with” access restriction) traffic assignment results are presented for ten road sections, five inside and five outside the LTZ. In the figure, section width refers to traffic flow. A grey filled area shows the Trastevere LTZ.



Figure 16 - Traffic flows in Trastevere with access restriction

In table 5, impacts in terms of percentage variations of emissions (CO, VOC, NOx, CO₂, PM) and Killed and Seriously Injured (KSI), in the reference period for the whole city, are shown.

Calculated percentage variation was low, but more evident than in S. Lorenzo simulation results. An increase of CO, VOC and KSI and a decrease of NOx, CO₂, PM was reported, due to the same reason already mentioned in the S. Lorenzo case study.

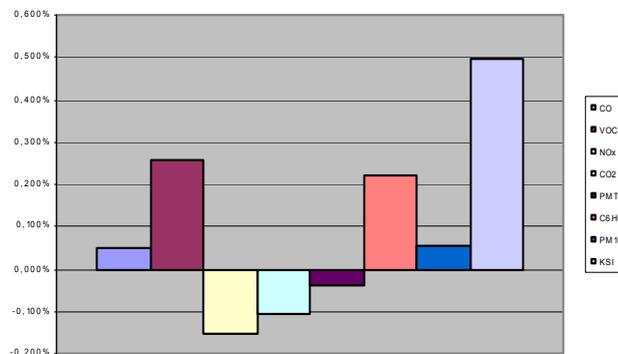


Table 5 - Percentage variation of impacts

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

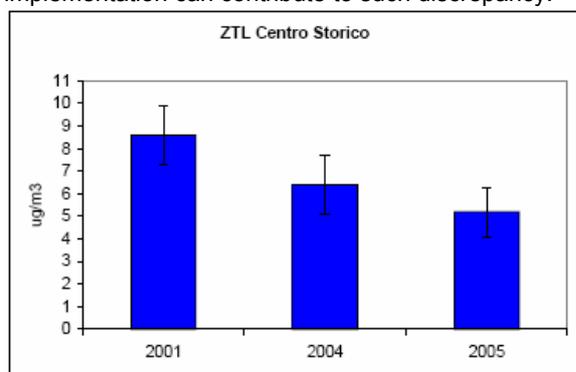
The degree of confidence in the model was pretty high since it was tailored to the Rome situation, and it was also successfully used for non-MIRACLES studies. It is obvious, however, that differences between the forecast and the really-achieved results are due mainly to the complexity of the real environment/context and to the manifold external factors that could affect the measure.

a.2.2.3) Ex post surveys

Two evaluation categories have been used to assess the ACS at Trastevere and S. Lorenzo: Environment and Traffic; main results are commented as follows

Environment

Concentrations surveyed in the central LTZ and in two districts (see Table 1) with passive sampler campaigns are in line with the decrease observed at urban level; the most positive outcomes were recorded at Trastevere rather than at S.Lorenzo, but the different morphology of the two districts along with other factors as the differences of time of implementation can contribute to such discrepancy.



ZTL di Trastevere		
T1	Via S. Francesco di Sales	4.8
22	Largo Cristina di Svezia	3.7
23	Vicolo della Scala ang. Vicolo del Leopardo	4.3
24	via Fienaroli ang. Via della Cisterna	5.1
25	Vicolo dei Tabacchi ang. Via Anicia	3.7
26	via S. F. a Ripa (dalla parte di via della Luce)	7.9
27	via L. Santini	4.7

ZTL di San Lorenzo		
AH1	Via dei Sardi	4.3
34	via Campani	8.3
36	Largo Osci	7.4
38	via dei Volsci (vesro P.za Sanniti)	5.5

Figure 17 - Mean values of benzene concentrations (2001 – 2005) in Central Rome, Trastevere and San Lorenzo.

Even more important can be considered the results shown in Table 1 about Noise pollution, referred to S. Lorenzo, (and in particular to Via dei Sardi, a busy street), to which the historical data were already available. During the monitoring of area, after the implementation of the measure, in zones without commercial activities it was observed a reduction of noise pollution of 8-9 dB(A) whereas in zones with commercial activities, as restaurant or pubs, the reduction of noise pollution was slight and was about of 3-4 dB(A).

Transport

In September 2005, traffic survey campaigns were carried out at Trastevere and San Lorenzo in order to verify the simulation results.

Specific analyses were carried out for Trastevere and San Lorenzo restricted zones. Figure 17 represents the results for San Lorenzo. The expected decrease due to the LTZ, even enforced only by Urban Police without electronic gates, was thus confirmed and the installation of electronic gates should foster such reduction trend, around 10% after stabilisation. However, it is easy to see that the highest traffic flows on the surveyed streets when the LTZ is off can be strongly reduced when the access restriction is on; indeed, surveyed values, always virtually above 100 veh/120min decrease to the half, and even to few units when LTZ is operative; an example can be provided by the trend surveyed along Via degli Ausoni, where early morning flows (no LTZ on) rise up to just less than 300 veh/120 min.; night flows (LTZ on) are around 20 veh/120 min.

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

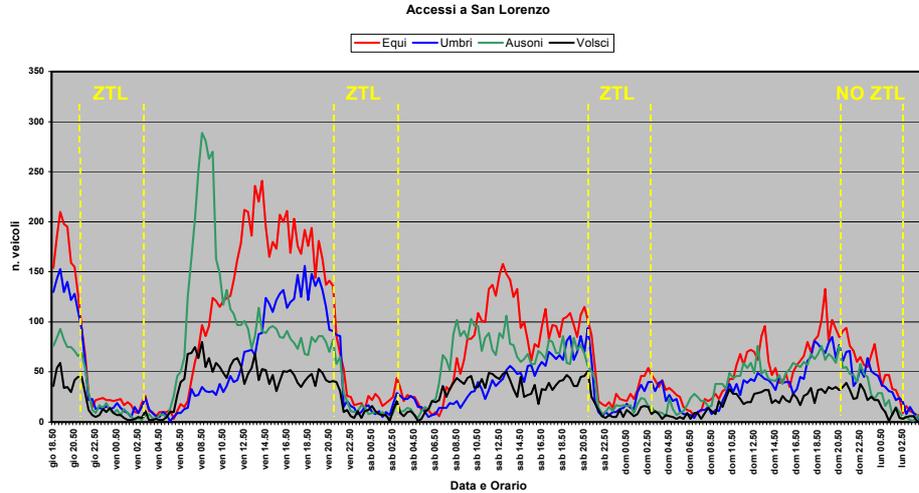


Figure 18: Traffic flows accesses in San Lorenzo area, with indication of LTZ (yellow dotted lines) working hours

For further details on the ex ante/expost comparison of 5.1b measures, see the following Table 6:

WP 5.1 access restrictions								
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Econ.1.a	2	Cost for operating the infrastructure (€/inh) referred all city pop.	2507,63				0,34**	No variations foreseen for frozen and trend scenarios **Value referred implemented measure
R5.1/Econ.2.a		Cost for maintenance of infrastructure (€/inh) referred all city pop.	72,15				0,10 **	No variations foreseen for frozen and trend scenarios **Value referred implemented measure
R5.1/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)		1) 0,9 2) 0,1	1) 0,9 2) 0,1	1) 0,8 2) 0,1	0,65	1)private car 2)PT
R5.1/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)		1) 1,1 2) 3,8	1) 1,1 2) 3,8	1) 1,0 2) 3,8	0,53	1)private car 2)PT
R5.1/Env.1.a		polluting vehicles (no of polluting vehicles)	1)868.72 2)441.11 3)64.796	a)465829 b)366923 c)1219910 d)1015645 e)2536	a)399728 b)35686 c)163014 d)158338 e)2536	a)397834 b)353689 c)163803 d)156311 e)2573	1)550.319 2)242.140 3)42.4353	The figure are referring to whole city and to: 1)Not cat cars; 2)Not cat 2-wheels; 3)Not cat comm. a)Gazoline car<1,4t b)Gazoline car>1,4t c)Diesel car <1,4 t d)Diesel car >1,4 t e)Buses
R5.1/Env.2.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)164972 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R5.1/Env.2.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city

Table 6- ex-ante (without do-something scenario) and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

WP 5.1 access restrictions								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.2.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R5.1/Env.3.a	5	concentrations of CO (millig/m ³)	1.77			No direct data available See table 2	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stat) (***)
R5.1/Env.3.b	6	concentrations of particulates (microg/m ³)	50.0				44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***)
R5.1/Env.3.c		concentrations of C6H6 (microg/m ³)	1)8.75 2)12,3 LA-H 6,8 LA - B 8,6 C				1)5.55 2)7.2 LA-H 4,8 LA-B 5,2 C 4,9 TR 6,4 S	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***) 2) Measured value by passive samplers method (**)

(**) Mean normalised value of all the 51 monitored locations in the Rail Ring Area (12 at LTZ, 7 at Trastevere, 4 at San Lorenzo, 5 at Tridente)

(***) The values of Villa Ada Station are not considered due to its use for the characterisation of the background air quality ATACTus of the city.

LA: Laboratory Area (H- Hot spot, B- background); C: ZTL, TR: Trastevere, S: San Lorenzo

Table 6- ex-ante (without do-something scenario) and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones (cont.)

WP 5.1 access restrictions								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.4.a	12	day/night level (dB(A))	L _{day} = 75 (1) L _{day} = 73 (2)	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 62 L _{night} = 55	L _{day} = 62 L _{night} = 60	The Baseyear values are referred to Viale Libia (1) and Via Nizza (2), within the laboratory area, other streets of the area respect the law limits during the day time (65 dB(A)). For baseline, frozen and trend scenarios no variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS
R5.1/Soc.1.a	13	awareness (%)	90				89	
R5.1/Soc.2.a		Satisfaction level (Lickert scale point 1 to 5)	3.88				3.27	

Table 6- ex-ante (without do-something scenario) and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones (cont.)

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

WP 5.1 access restrictions								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Tran.1.a	21/22	modal split (motorized and non motorized) (%) of the total flow)	1) a)20 b)48 c)11 d)21 2) a)30 b)27 c)23 d)20	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 18 b) 47 c) 8 d) 27 2) a) 31 b) 22 c) 24 d) 23	1) whole city 2) Rail Ring Area a) PT b) Priv 4-wheels c) Priv 2-wheels d) Walking
R5.1/Tran.1.b	21/22	traffic levels (trips day per vehicle)	2,2	2,5	2,5	2,5	2,5	
R5.1/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42	1)4,8 2)1,53	1)4,8 2)1,53	1)4,9 2)1,55*	1)6,1 2)1,5	1)whole city 2)Rail Ring Area
R5.1/Tran.2.a		Number of fatalities (deaths/10 ⁶ inh)	115,29				65,33	No variations foreseen for frozen and trend scenarios Base year and Ex-post value referred to whole city
R5.1/Tran.3.a		Routes (no.)	2				5+1	No variations foreseen for frozen and trend scenarios
R5.1/Tran.3.b		Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				50	No variations foreseen for frozen and trend scenarios
R5.1/Tran.3.c		travelled people (no.) (clean vehicles only)	16000/ 17000		15944/ 16941	16167/ 17178	10000/12000 pax/day electric buses 32000 pax/day trolleybus	
R5.1/Tran.3.d		Trips per line (no./day)	206				216 express 109 electric	No variations foreseen for frozen and trend scenarios

Table 6- ex-ante (without do-something scenario) and ex-post results in Rome: WP 5.1 Set-up of a city centre clean zones (cont.)

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Reduce transport related emissions by 5% in the Laboratory Area and by 13% in the LTZ.	CO emissions values reduced by about 76% For particulates and C6H6 emissions values, the reduction was about 38%.	<i>Such results exceeded the scenarios forecasts concerning transport-related emissions, where reductions of 13% had been estimated inside the LTZ and 5% in other parts of the Laboratory area. Such results are also fostered by positive outcomes in terms of concentration reductions</i>	☺☺☺
2) Reduce peak hours car traffic by 3% in the whole Demonstration Area	Traffic flows in Laboratory decreased by 5% daily, (2001-2005), but the trend is to be monitored because during peak hours still congestion phenomena occur	<i>To be noted that the trend of the traffic flows is becoming to decrease at city level, as by the traffic counting system run by the traffic Control Centre in ATAC</i>	☺☺
3) Reduce the number of polluting vehicles by 10% in the Demonstration Area	The number of non-catalysed vehicles e.g. non-catalysed mopeds reduced by about 45%, private cars by 37% and commercial vehicles by less than 35%.		☺☺☺
4) Reduce not authorised entrances by 30% in the LTZ, S. Lorenzo and Trastevere	Traffic flows accesses at S. Lorenzo decreased more than 50%	<i>The illegal entrances were 15% of the traffic total flow in Central LTZ end 2001. End of 2005, they are about 7-8%, i.e. 50% reduction Same qualitative trend is observed at Trastevere</i>	☺☺☺
5) Increase walking by 5% in the Laboratory Area	Rail Ring Area (where all the measures are implemented) showed a large decrease (5%) in the use of private cars in favour of walking (3%) and transit (1%).	<i>The five point decrease (percentage) for private cars in favour of three point increase (percentage) for walking was considered a noteworthy result, and suggested that citizens reduced their use of the car for trips of short distances.</i>	☺☺
6) Reduce private peak traffic flows by 4% in the LTZ	Reduced by 20% during the whole restriction period and by 15% in the morning peak hour (8.30-9.30).		☺☺☺

Caption

☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level
 ☺ difficult to assess ☺ not achieved

Status of the Measure beyond MIRACLES and Upscaling

The measure (including all the subtasks) is currently partly operative, it is going to be completed and it will continue beyond MIRACLES. In the following, some pictures before-after the implementation of the electronic gates in two sites are reported: the evidence of the territorial re-qualification is impressive, as well as the importance of the new gate signalling system.

Upscaling possibilities were favourably assessed by local implementers for the "Limitation to entry the whole Laboratory Area to only catalysed vehicles" measure; in particular, the main reason to upscale it to the whole metropolitan area (Green Band and after that to the main road ring – the so-called GRA of the City) was due to

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

benefits coming from the possibility to reduce the most pollutant vehicles types.



Figure 19: Situation before-after the implementation of the electronic gates in two Trastevere sites.



Figure 20: Implementation of the new gate signalling system in three sites.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Rome decides to set-up new clean zones with a complex series of actions, according to the guideline provided for the internal areas of the city by the Urban General Traffic Plan (PGTU). Besides, there are in Rome serious reasons to apply “clean zones”: congestion and environment as well as a strong need to preserve the historical and archaeological city.

Anyway, even if the Urban Traffic Plan included such measure, the implementation of electronic access control schemes in Italy had a complicated initial set-up.

MEASURE-LEVEL RESULTS	
Measure title: Set up of City Centre Clean Zone:	Project: MIRACLES
Measure number: 5.1b Access control systems in central areas	City: Rome
<p>The Rome request was the first one for automatic ACS+RP scheme in Italy and the government Bodies examined it carefully, establishing the parameters for its operation. Due to the complexity of the procedures related to the use of such automatic equipment to be made operational on large scale for the first time in Italy, the Decrees obliged to a pre-exercise period, to be jointly operated with the Urban Police at each gate to endorse the violations. London implementation is giving support to Rome, previously alone within the largest European cities to apply an electronic enforcement system.</p> <p>Support comes also by the new restrictive air quality Directives recently approved and obliging further restriction of the private motorization to comply with them.</p> <p>The full-scale deployment of automatic access control systems in Rome required the resolution of a number of issues, ranging from a technical nature, to the management issues of such a system, and finally to a variety of bureaucratic and institutional issues.</p> <p>It is essential to highlight that the decision to replace the human control to the LTZ accesses with an electronic eye cordon, however complex, is accompanied by the awareness of completely re-design the whole logical process. It begins from the decision regarding criteria to release access permission to zone, continue with the dissemination campaigns to inform all the citizens, the application of an experimental period up to the real enforcement with emission of the fines.</p> <p>There is the need to consider the whole process in terms of requirements in order to assure that the technological solution can become efficient, reliable and convenient both to the City Administration and to the citizens. As a consequence, the definition of the chosen ACS+RP scheme and of the technical requirements is a primary step in the project and you should be ready to change your mind in any moment before the implementation.</p> <p>Surveys and continuous contacts with all the stake-holders and definition of the needs of all the social categories are necessary and it is important to integrate this kind of measure in Sustainable Mobility policy with PT integration and introduction of pedestrian areas.</p>	
M13: Interrelationships with other measures	
<p>6.1 Pricing policies, 7.2 Information -Awareness raising aspects of WP10 – WP3 and in particular the impact of highly polluting vehicles.</p>	
M14: Lessons learned	
<p>The right mixture of limiting measures, flexible solutions and technology supports must cope with the everyday problems. Every measure has to be evaluated before and needs an experimental period where set-up all the particularity of the measure itself with all the involved actors and stakeholders. There is also a need of facing new technology development and the application of Galileo VPS related system.</p> <p>The integration of ACS, RP and clean zones in “Sustainable Mobility” policies can support the matching of the new limits on air quality.</p> <p>There is need of time to consolidate the implementations and scheme acceptability: the four years of Miracles Project are just the “beginning” of the sustainable mobility strategy in a city complex like Rome. Anyway, the EU RTD Projects are adding value in supporting analysis and choices and the awareness activities: see in the next pictures the leaflet for the opening of the gate system in Trastevere.</p>	

MEASURE-LEVEL RESULTS

Measure title: Set up of City Centre Clean Zone:

Project: MIRACLES

Measure number: 5.1b Access control systems in central areas

City: Rome

La ZTL Trastevere

Nel rione Trastevere il _____ entra in vigore la nuova Zona a Traffico Limitato (ZTL) del settore G.

Terminata la sperimentazione, il Comune di Roma ha reso definitivo il provvedimento, ampliando i confini dell'area e realizzando il controllo degli accessi tramite varchi elettronici.

Gli orari della limitazione del traffico ai non autorizzati sono stati modificati:

- dal lunedì al sabato, dalle 6.30 alle 10.00
- il venerdì ed il sabato, con inizio alle 21.00 e termine alle 03.00 del giorno successivo

Un pannello elettronico ad ogni accesso indicherà gli orari e i giorni di vigenza della nuova ZTL.

Il nuovo parcheggio Atac di Trastevere e il Terminal Gianicolo consentiranno di lasciare l'auto ed utilizzare le linee 115 e 125 per entrare e circolare nel rione Trastevere negli orari della limitazione del traffico.

ROMA **atac**

Progetto cofinanziato dal Ministero dell'Ambiente e del Territorio e con il contributo (C.P. - Azione C) di CIVITAS

Scopri come cambia la tua città:

RIONE TRASTEVERE

la nuova ZTL

e il sistema di controllo dei varchi elettronici

Città antica, nuove porte

800-431784

Figure 21: Leaflet to inform the citizens of the official opening of Trastevere e-gates.

In general, the private demand management is critical: hybrid ACS+RP scheme using ITS technologies is a success story, to be extended using the necessary changes in each different zone.

According to the successful lessons learned so far within the CIVITAS framework, most of the initiatives continue to be carried out through the involvement of the main actors, and the harmonisation of the activities; it is noticeable the concerted effort spent in the implementation of the new Access Restrictions (Trastevere and San Lorenzo).

Besides, an added value of access control schemes is the comprehensive re-qualification obtained with the implementation of the e-gate system. Any installation in these zone created the opportunity to limit the space for private car, giving back areas to pedestrian mode in particular.

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4. Measure 5.2a – Pedestrian Areas

MEASURE-LEVEL RESULTS	
Measure title: Implementation of pedestrian areas	Project: MIRACLES
Measure number: 5.2.a	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>This measure focuses on the re-organisation of road infrastructures in order to improve city's actions for the development of clean zones and areas, according to the following:</p> <ul style="list-style-type: none"> - To increase environmental protection of the city centre, also implementing retractable bollard systems to physically protect pedestrian areas. - To implement extension of Green Zones in Rome especially in the zones of the historical downtown, mainly with "Tridente" pedestrian area - To confer continuity to the pedestrian streets in the areas of historical and cultural interest, with the creation of a pedestrian network inside the LTZ. 	
M2: Measure description:	
<p>The Municipality is aiming to create an "Environmental Islands" inside the City Centre through interventions on traffic limitation in order to prevent the vehicular traffic through circulation schemes "daisy" based, in order to avoid the traffic crossing.</p> <p>The Clean Zone concept in City Centre</p> <p>Clean zone are areas organised to boost alternative sustainable transportation modes, as pedestrian mode, and where pollution is minimised, according to the following action-plan:</p> <ul style="list-style-type: none"> - The design and implementation of the TRIDENTE pedestrian area inside the central LTZ - operative from Monday to Friday from 8.00 to 20.00; - The completion of Green areas in the city centre. These are realised also implementing retractable bollards in order to identify and limit access into these areas and re-designing PT infrastructures. Pedestrian safety is also improved into these areas by means of safe pedestrian pathways. - Other areas identified to become "green areas" are: <ul style="list-style-type: none"> • The Trastevere District (I phase – 18 bollards, II phase – 4 bollard); • The area surrounding Campo dè Fiori - P.zza Farnese (Historical city centre – inside LTZ). • A complete pathway across the City Centre, including renewing of squares and streets and a new pedestrian zone, called "D2". 	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The innovative aspects is that in Rome the accomplishment of a "closed area" is realised combining access restriction with safe pedestrian pathways inside an integrated approach involving both ITS and PT integration, with sometimes mobile bollards accompanying pedestrian pathways. This will permit to carry out an area where mobility policies, improvements, new technologies are implemented and tested.</p> <p>The integration among different policies involve both citizen behaviours and technological issues. Besides, a suitable rationale public space use, safeguarding citizens health and preserving historical and architectural heritage, allows improved mobility conditions as well as safety increase and air and noise pollution decrease.</p>	
M4: Situation before CIVITAS:	
<p>Even if according to the Urban Traffic Master Plan, presented in year 2000, the strategy to rebalance the modal split towards public transport and promoting alternative modes of transport, the situation in Rome before MIRACLES needed development in terms of limitation of private traffic. Pedestrian pathways, before CIVITAS, were few and scattered in central areas of the city.</p> <p>Before the Miracles project, the pedestrian areas in the city centre of Rome were absolutely limited to small portion without any "green" connection among them.</p>	
M5: Design of the measure:	
<p>At this stage, a surprisingly high number of pedestrian areas was established in the city centre, with the TRIDENTE large zone. It is now possible, at least in some hours of the day, to stroll the whole city centre without the presence of private traffic flows, excluding some crossings. Besides, some specific parts are now protected by mobile bollards.</p> <p>Besides, City Council approved the new General Plan for Urban Traffic: this plan was examined in 2005 by the citizens for the process of "participated democracy" before the definitive approval of the plan, to be achieved</p>	

MEASURE-LEVEL RESULTS

Measure title: Implementation of pedestrian areas

Project: MIRACLES

Measure number: 5.2.a

City: Rome

within end of the Council Mandate in May 2006. It privileges the pedestrian mode especially in the city Centre, introducing for the first time the concept of “environmental island”, where inside the maximum speed will be limited to 30 km/h and where the bicycle mode is favoured.

The whole design of the measure comes from an integration between the needs of preserving the Roman heritage in terms of historical sites and to improve the life conditions inside the whole City Centre and it includes two measures:

- ❖ Completion of Green areas inside the city centre, also through retractable bollards a protected area and re-design of PT infrastructures included in these areas and improvement on pedestrian safety.
- ❖ Design and implementation of the pedestrian area between 8.00 and 20.00 every workday in the TRIDENTE area inside central LTZ.

The project in its complexity includes the creation of small pedestrian areas inside the Central and Trastevere LTZs, in order to create a connected pathway among the different central areas and Point of Interest (POIs). The whole project is represented in Figure 1.

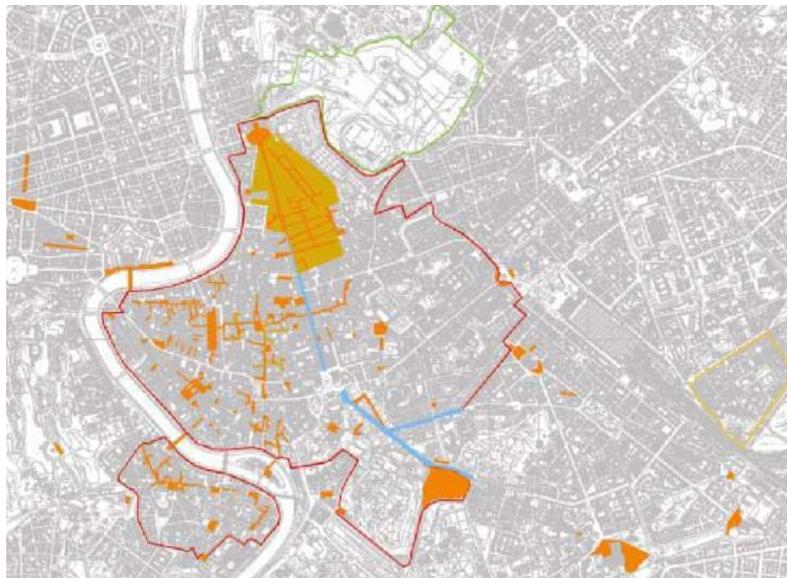


Figure 1 - Pedestrian areas inside the City Centre of Rome

1) Completion of central Green areas integrated with retractable bollards system

This task aims basically at increasing environmental protection of the city centre and implementing the extension of Green Zones and pedestrian areas in the Laboratory area in Rome. Implementation of protected area through bollards within the Rome historical centre is a part of a set of strongly co-ordinate actions aiming at limiting access of private flows within the inner part of the city, and improving the level of service of pedestrian areas. The consequence is a reduction of environmental impacts as noise and pollution.

In detail, the aim of the task consists in completion of the already established Green areas inside the city centre with retractable bollards system in Campidoglio hill (10 bollards), Senate surroundings (16 bollards – also for security reasons), P.zza Capranica and surroundings (8 bollards), Trastevere District pedestrian pathway (17 bollards).

A preliminary project was submitted to VII Department on April 22nd, 2002; the Municipality of Rome approved the preliminary project and promoted its examination in the External Bodies Conference, a step expected by the law on public works in Italy. The project has been finally approved on July 2002. A large consensus has been reached during External Bodies Conference by all the actors involved in the examination process.

The **main problem** during the design phase has been the tuning of the access restriction for emergency and safety services. This issue carried out a re-calibration of the whole project working closely together with the security forces. The project of retractable bollards is articulated as follows.

1. Regulation plan.

The main problem of bollards installation is to guarantee accessibility for special cases or activities and, at the same time to dedicate special lanes to pedestrian in order to build up safe pathways.

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Bollards need to be operative in Trastevere for a twelve hours shift, starting from 4.30 pm until 4.30 am in order to allow the main basic operations such as freight distribution, to be performed until 4,30 pm.

Special authorisations (Car park and/or carriage gateway owners, disabled people, Emergency and/or special vehicles Electrical vehicle etc),.

2. Architectural design:

A dedicated study for site implementation has been provided in order to maximize effectiveness of bollards. In particular, in Trastevere District nine sites have been identified to be equipped in order to create an in/out gate.

3. Traffic Plan: a detailed traffic plan has been provided, in order to guarantee minimum of stream conflicts.

4. Executive Design: the project is based on control room where system activities are to be managed. In details, the oleo-dynamic bollards will be connected to the control room in order to be controlled remotely; control room will be also the appropriate site where maintenance and emergency will be managed. Furthermore, equipment adopted and implemented will need of a calibration phase to work properly. So a pilot phase will be provided in order to test equipment and impacts. Anyway the final configuration will be oriented to a valorisation of the areas and to a reduction of the impact with the pre-existing urban environment.

5. User awareness campaign: in parallel with system implementation, an user awareness campaign will be provided in order to show the benefits of the new system, and to explain who will be allowed to enter and how to obtain permission.

In the following Figure some already operative devices are reported, at Campidoglio hill and Senate surroundings



Figure 2 - Mobile Bollards installed in Campidoglio and Senate pathways



Figure 3 - Mobile Bollards installed for protecting Senate/Pantheon pathway

2) TRIDENTE and New central Green areas

In Rome, due to mostly individual traffic, a high air-pollution and traffic congestion is registered. In the city centre, the most evident means of transport are scooters or motorbikes. The weather conditions, the traffic congestion as well as their speed within the narrow streets of the inner city are the most important arguments for the use of the thermal two-wheeler: about 450.000 scooters and motorbikes are circulating. The use of two-wheelers is increasing continuously due to the traffic congestion as well as to the necessity of a lot of people to enter the

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Limited Traffic Zone, still opened to all two-wheeled vehicles without any restriction. On the one hand, the two wheelers helps to reduce the traffic congestion, on the other side the emission of NOx and PM10 of a non-catalysed scooter are almost as high as those of a diesel powered car.

Studies made in Rome 2001 were confirming that non-catalysed thermal scooters (two strokes) emit large quantity of PM10. The public administration is keenly seeking for strategies to reduce this kind of pollution, favouring the e-scooters. A high air-pollution of PM10 and NOX is the consequence mostly due to the two-stroke non-catalysed vehicles. The fundamental step to go towards the introduction of less/zero polluting vehicles-scooters could be the closure of specific areas in the city centre for the non catalysed thermal ones.

Simulations were already carried out in the 2001 yearly air quality report for the city of Rome. The results in terms of reduced pollutants were impressive.

During the period of December 8th, 2002 – January 7th, 2003, the same portion of the LTZ where the simulation were carried out was closed to thermal vehicles and it remained open to the e-scooters.

The experiment was successful and, in order to manage 2-wheels related pollution, the Rome City Council, pursuant to Deliberations no. 725/2002 and no. 19/2003 of the Executive Committee, approved by Executive Decision no. 408 on 6 March 2003, established a green zone in a small area, internal to the LTZ, identified as LTZ-A1 (**Tridente area**),

The policy that has been implemented within the Tridente area is very restrictive: entry is prohibited seven days a week, between 10.00 and 20.00 to private cars, mopeds, motorcycles and motor vehicles (including trucks). To control this area 4 guarded gates (see Figure 4), are patrolled by local police.

Access to streets inside Tridente area is permitted between 8 pm and 10 am. In any case, drivers of commercial vehicles wishing to access this area must make sure that the appropriate documentation testifying to the nature of the company's business is always kept with the vehicle. There are exceptions for some categories to enter the Tridente area during the restrictions, such as: residents with private parking lot inside the area, disabled, public utility vehicles, electric vehicles and public transport, vehicles in the case of: emergencies and/or contingent situations.

Electric two wheelers can become an important means of transport for the access to the inner city centres of the large cities. Economic incentives for purchasing of electric vehicles were settled by the Municipality of Rome and, to support such a rapid increase of electric vehicles, a network of recharging points, located in public and private areas has been planned and partly realised (see WP12).

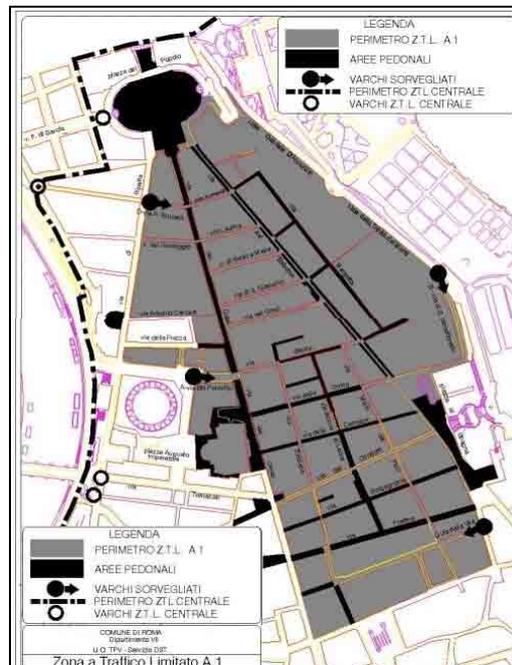


Figure 4 - The Tridente pedestrian area

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Figure 5 - Via Del Corso, inside the Tridente area, during the traffic limitation period

In October 2004 the City Council, with Act n° 678/04 instituted **new pedestrian areas in the central area**: (part of piazza Capranica, via della Maddalena, piazza della Maddalena, a portion of via di Santa Chiara and of via dei Cestari, via della Palombella).

In these areas, transit permitted only to freight vehicles (from midnight to 10 am). In the surrounding streets – a new internal Limited Traffic Zone was instituted, called **“ZTL D2”** (Figure 6),.

At this stage it is possible to see for the first time an almost-connected pedestrian path across the city centre

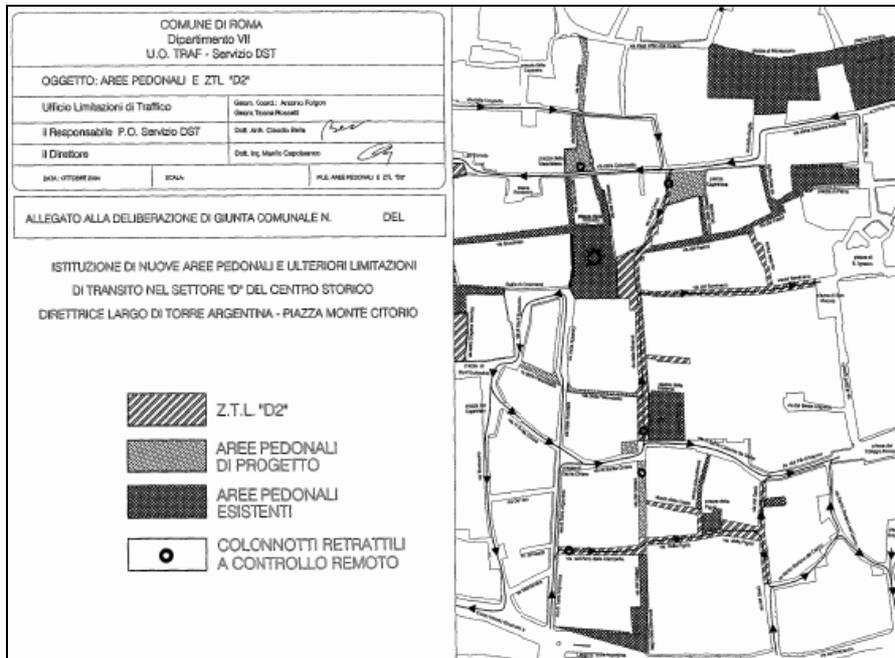


Figure 6 - The ZTL-D2 pedestrian area

Besides, during Miracles other pedestrian areas were achieved, fully or partly, when due to the traffic flow direction was impossible to completely close the zone to the traffic. Here reported is the Parliament square, before and after the intervention. (Figure 7), , but other intervention were completed in Piazza dell'Orologio,

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Piazza della Pilotta, Piazza della Pigna as well as the new area surrounding the Roman monument of Ara Pacis was completed.



Figure 7 - Parliament square before and after the -pedestrian intervention

M6: Actual implementation:

During Miracles, bollards were installed to protect Campidoglio hill pedestrian pathway and Senate/Pantheon pedestrian areas. These activities were privileged due to the need to combine security and pedestrianisation. Besides, the Council Act n. 661/04 expects the installation of the mobile bollards system for Trastevere pedestrian path, to be achieved in 2006.

The ZTL D2 new pedestrian zone, which was an unexpected achievement, will include the implementation of mobile bollards, to be chosen together with Trastevere Project. The bollard system in these two areas will be completed within 2006

To implement the Tridente pedestrian area by means of the Executive Decision n° 408 of 6 March 2003 political issues have been pursued. In fact, Executive Decision n° 408 of 6 March 2003 is the result of a process launched by Executive Decision n° 1811 on 6 December 2002 that took the following steps:

- From 7 to 23 December 2002, the period of restricted access in the central Limited Traffic Zone was increased to seven days a week (i.e., including Saturdays, Sundays and public holidays), and from 6.30 am to 8 pm;
- The creation of another Limited Traffic Zone – the TRIDENTE (LTZ A1) within Sector A, where motor vehicles would be prohibited between 10.am and 8 pm, seven days a week, from 7 December 2002 to 6 January 2003..
- As of 7 January 2003, the area of the above mentioned the Tridente (LTZ A)1 was increased, reaching the present status.

Due to the success of this measure the Municipality of Rome has decided to implement a new pedestrian area (ZTL-D2) inside the Limited Traffic Zone. The same traffic regulation adopted for the TRIDENTE area has been implemented.

M7: Deviations from the plan:

None, but the delay in implementing Trastevere Bollard system, to be recovered mid 2006.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For the 5.2a measure deviations occurred to the following indicators:

Evaluation category: *Energy*

- *Energy efficiency per transport mode*: added, due to the ITEMS application

- *Vehicle fuel efficiency*: added, due to the ITEMS application

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: removed because such costs were already included in the “cost for operating” indicator

- *Income from PT sold tickets*: in spite of what initially planned this indicator cannot be realistically quantified; indeed ATAC collects only overall data on sold tickets and not line by line; it is important to stress, however, that

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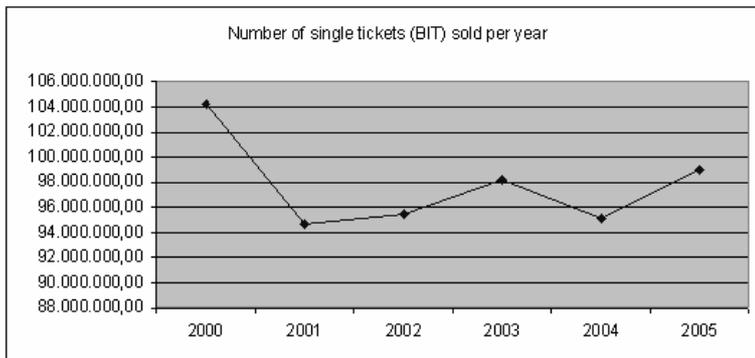
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according to such yearly data, a decrease was recorded. Such trend is qualitatively detectable also for lines operating on measure 5.2a areas.

year	Number of single tickets (BIT) sold per year	diff.	Average diff.	diff. (%)	diff. (in comparison to baseline)	Average diff. (in comparison to baseline)	diff. (%) (in comparison to baseline)	Average diff. (%)
2000	104.257.135,00							
2001	94.701.146,00	-9.555.989,00	-1.053.050,80	-9,17%	-9.555.989,00	-7.767.798,60	-9,17%	-1,01%
2002	95.446.551,00	745.405,00	-1.053.050,80	0,79%	-8.810.584,00	-7.767.798,60	-8,45%	-1,11%
2003	98.180.888,00	2.734.317,00	-1.053.050,80	2,86%	-6.076.267,00	-7.767.798,60	-5,83%	-1,10%
2004	95.126.236,00	-3.054.632,00	-1.053.050,80	-3,11%	-9.130.899,00	-7.767.798,60	-8,76%	-1,07%
2005	98.991.881,00	3.865.645,00	-1.053.050,80	4,06%	-5.265.254,00	-7.767.798,60	-5,05%	-1,11%



Evaluation category: *Environment*

- *Noise level*: removed because included in measure 5.1

Evaluation category: *Transport*

- *Average speed*: removed because not interesting (pedestrian areas)

- *Number of trips (PT, Average delays/waiting time, Reliability)*: removed because of scarce relevance in pedestrian areas

Evaluation category: *Society*

- *Crime rates*: removed; the indicator was not useful, because it was very difficult to assess whether any MIRACLES measure, or a cluster of them, could be reasonably linked to any variation of security. The reason relied on the matter that this kind of information is often merely quantitative and doesn't take into account the personal perception of security, felt by the users. Moreover, data are usually underestimated since, very often, most of occurred crimes are not officially reported because of the nature of the attack (very small offences, as pick-pockets on buses), of the absence of someone to report to, of not confidence that the offender will be caught, etc.

- *Type and no. of provisions for disabled people*: moved to measure 7.2.1 because more suitable to describe it.

- *Acceptance*: merged into "satisfaction level" indicator

- *Use motivation*: merged into "satisfaction level" indicator

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Given the high number of indicators several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results

Environment indicators

Information on environment comes from air quality assessments concerning the emissions of CO, particulate and benzene. For the ex ante and ex-post evaluation, data from ATAC traffic control center were used. Here, due to the outcomes from measure 11.2.2 (see related template) a complete traffic-environment chain was integrated, giving the traffic flow on the whole primary network of the Laboratory Area. The traffic information are converted into emission parameter through the integrated TEE model, supplied by ENEA. It calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry.

For what concerned pollutant concentrations, still indicators about CO, particulate and benzene were studied, mainly coming from Air Quality monitoring ATAC stations network in the city of Rome.

Moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration were

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carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution was available. In particular, air quality data were acquired by the monitoring stations of the laboratory area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives. Benzene was measured by a passive samplers method, i.e. the Radiello® diffusive sampler; these are samplers in which the diffusive and absorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially and parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface. The BTEX, sampled in urban environment by the cartridge are thermally desorbed.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called "dense words" in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a "strong" emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Transport Indicators

For the baseline, and in general for the ex ante analysis, a big part of information concerning mainly the quantitative indicators was developed before, after and during the 2000 Jubilee. For this event esteems, models, surveys, measurements on the most relevant spots were run in order to quantify and to check impacts as the changes of traffic, of parking and of the Public Transport service. Such surveys were repeated after the 2000 Jubilee event thanks to other occasions, as other special events or other EC projects involving Rome. Besides, the set-up of the so-called "Mobility Observatory" in ATAC by the Mobility Department permitted a continuous updating of all the mobility data, thanks also to data coming from the ATAC Traffic Control Centre. Here, due to the outcomes from measure 11.2.2 (see related template) a complete traffic-environment chain was integrated, giving the traffic flow on the whole primary network of the Laboratory Area.

Besides that, information coming from the Environmental Department of the Rome Municipality, especially from the yearly report on the air quality status in the city, were used. For what concerns Public Transport, the ATAC "infopoint" (a GIS based database) continuously provided information on the service. Hence, to describe the ex ante phase, most of quantitative information were obtained by existing database, which were continuously updated to collect data available for the ex post phase. Information on pedestrianization issues have been collected from the so-called "Mosaico Statistico", a bulletin on mobility issues edited on line by Rome Municipality.

For what concerns the Miracles scenario, indicators were defined applying a model methodology. To model correctly user behaviour before and after the introduction of the measure, existing data coming from other projects were used to simulate the impacts of the assessed measures. To simulate access restrictions results two O/D matrices representing authorised and not authorised car users trips and access rules to LTZ were considered. The model was based on user equilibrium multi-class (i.e. the two classes authorised and not authorised car users) assignment procedures, where travel time of each link in the network was calculated iteratively with specific link performance functions.

The private transport graphs and the O/D matrices were supplied by STA and elaborated by DITS. For the supply model the whole Rome urban area was taken into account. The network was based on a graph of 4861 links and 3367 nodes.

The link performance functions used in the model were in BPR (Bureau of Public Roads) formulation, where travel time on a link was a function of the link capacity and the traffic condition, i.e. the number of vehicles travelling on the link. The used model was based on a subdivision of Rome urban area in 495 traffic zones corresponding to 495 centroides.

In the Tridente simulations, the morning peak hour was taken into account. Two matrices, supplied by STA, were related to vehicles with and without permit to access the LTZ of Rome historical centre. Besides, the Tridente simulations were verified by a specific on-field survey in September 2005.

Other indicators

For what concerns the ex ante phase, Economy Indicators came from the UITP Millennium Database, whereas there were no data useful to describe directly the baseline situation of the energy indicators, but those ones

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elaborated thanks to the ITEMS exercise. Ex post measurements were provided by local partners.

M9: Achievement of quantifiable targets:

The main goal for this measure is to reduce the road space for cars inside the LTZ by 2% and to raise citizen awareness by 10% in specific areas inside the Laboratory areas. See M11 for the achievement of these results.

M10: Achievement of evaluation-related milestones:

M1: Set up of the pedestrian area of Tridente: 2003: achieved 1 year in advance, January 7th, 2002.

M2: Set-up of retractable bollards: 2004: achieved on Campidoglio hill and in Senate/Pantheon pedestrian pathway. Expected in 2006 for Trastevere District pedestrian pathway

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The Tridente ex-ante scenario and the creation of the pedestrian network outcomes
- b) A short mention on the general outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- c) A comparison between quantifiable objectives and actual achieved results

a) The Tridente and the creation of the pedestrian network outcomes

Main results concerning the pedestrianization schemes are reported according to two sub-sections: the study of the MIRACLES Scenario due to the creation of the "Tridente" pedestrian area inside the central LTZ, and the ex post assessments of the implementation of all the 5.2 measures

a.1) The Miracles scenario

The simulation scenarios

Two scenarios were into account for the simulation: "without" and "with" the measure. Both simulation scenarios were referred to the morning peak hours, when the central LTZ is operative. In the first scenario ("without" pedestrian area) only vehicles with permit to main LTZ were admitted. In the second one ("with" pedestrian area) streets inside the pedestrian area could not be travelled.

The simulation results

In figure 8 ("with" pedestrian area) simulation results are presented. The pedestrian area is represented by a grey filled area. Because of the morning peak hour, many sections were characterised by a high number of vehicles as indicated by the width of the flow of above mentioned figure. In total ten road sections, five inside and five outside the area, were analysed.

By the introduction of access restriction to all vehicles, section flows inside the area decreased to zero and no considerable changes occurred outside the area.

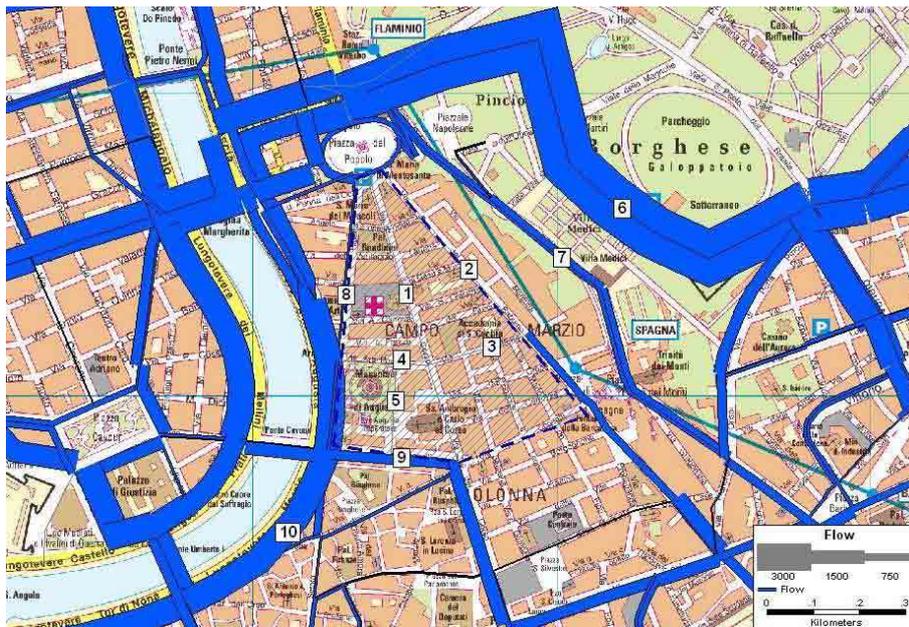


Figure 8 - Traffic flows in Tridente after pedestrian area implementation

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In table 1, total flows for each section are reported both for with and without scenarios. In the last column of the table percentage flow variation is also reported. Altogether, there was a little percentage difference outside the area. A flow increase could be observed in Viale Trinità dei Monti (7) and via di Ripetta (8), the streets nearby to the Tridente area, whereas streets in the south of the area, Via Tomacelli (9) and Lungotevere Marzio (10), presented a decrease.

	Section	"without" scenario	"with" scenario	Difference (%)
Inside Tridente	1 Via del Corso	230	0	-100,0%
	2 Via del Babuino	266	0	-100,0%
	3 Via Vittoria	701	0	-100,0%
	4 Via Ara Pacis	588	0	-100,0%
	5 Piazza Augusto Imperatore	55	0	-100,0%
	Subtotal	1840	0	-100,0%
Outside Tridente	6 Via del Muro Torte	7847	7833	-0,2%
	7 Viale Trinità dei Monti	977	1051	7,8%
	8 Via di Ripetta	21	270	1185,7%
	9 Via Tomacelli	1245	1145	-8,0%
	10 Lungotevere Marzio	3275	3145	-3,9%
	Subtotal	13365	13445	0,6%

Table 1 - Traffic flows variations

Table 2 shows the differences of emissions (CO, VOC, NOx, CO2, TPM, C6H6, PM10), expressed in Kg, in a logarithmic scale. The percentage variation for all the emission categories, as well as for the number of Killed and Seriously Injured (KSI), was 0,0042%.

Due to the increase of vehicle-km, an increase of emissions and a reduction of safety level could be estimated, even though, in absolute term, the overall effect of measured factors can be considered negligible.

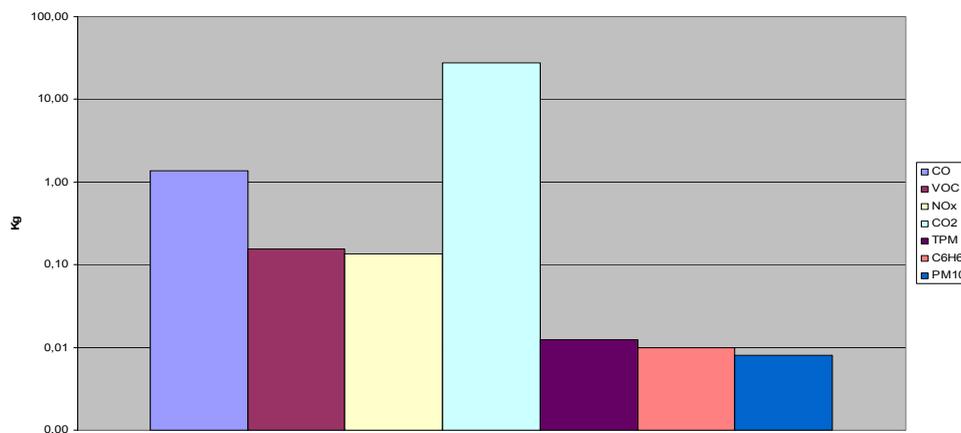


Table 2 - Percentage variation of impacts

a.2) Ex post surveys

In the 5.2 package of measures the Tridente pedestrianization is the most relevant measure, in terms of area and of implementation process; hence, such measure plays the main role in the achievement of benefits, whereas the extension of the pedestrianization to other central areas can be considered as a follow-up of the Tridente practice, enhanced also by the implementation of bollards.

Three evaluation categories have been used to assess these measures: Environment, Society and Transport; main results are commented as follows

Environment

As shown in Table 1, improvements, for what concern concentrations, due to the simple removal of cars from the Tridente area, were clear. Indeed, for what concerns Focusing on Benzene, as shown in the following figure, the values measured at the Tridente area were the lowest among those surveyed in all the WP5 sites (4.1 microg/m³ at the Tridente vs. 5.2 microg/m³ in the whole Laboratory area), exceeding the predictions of the ex ante simulation. The removal of car traffic for most part of the day is obviously the main driver of such achievement.

The mean values of such pollutant from passive sampler campaigns in the same sites are shown; the decrease from the baseline (2001) is evident.

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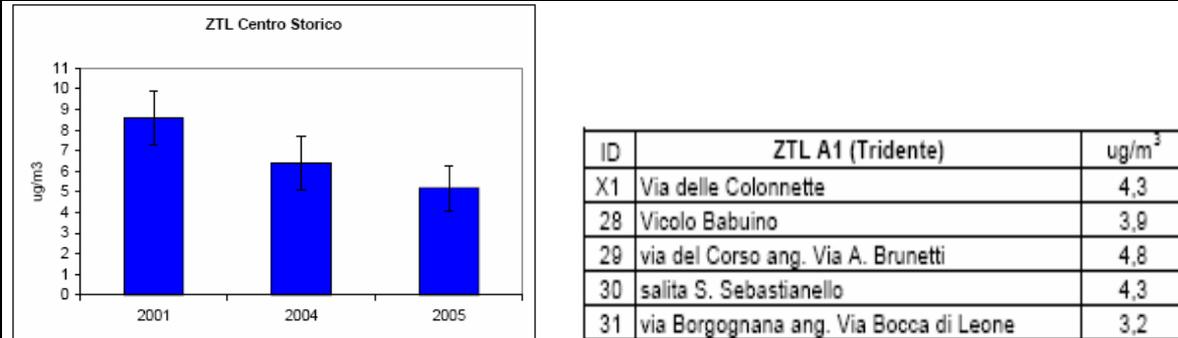


Figure 9 - Mean values of benzene concentrations (2001 – 2005) in Central Rome and Tridente sites.

Society

Citizens were asked to assess in general the whole package of WP5 measures; in comparison to the baseline surveys Awareness level did not show appreciable variations, whereas Satisfaction level drops from 3,88 to 3,27 points of a 1 -5 Lickert scale. Such results should prompt that even though pedestrianization can be considered the “carrot” (in comparison to the “stick” of the restriction measures, as the ACs) of the whole WP5 measures, still pedestrianization is considered an unpopular choice, since people cannot properly individuate positive consequences, as for instance the benzene concentrations decrease.

Transport

In general, modal split was influenced by all the Miracle measures, but local effects in Tridente showed a modal split totally shifted towards soft modes. This could be also supported by the good performance of transit, which strongly increased in terms of travelled people and of supply.

Another interesting result concerns the safety level; indeed, despite the predictions of the ex-ante simulation (esteemed for both the synergic implementations of restrictions and pedestrianizations), safety levels did in fact improve noticeably. The forecasts anticipated an increase of accidents because of the shift from cars to mopeds / motorcycles by those drivers who used to travel through the formerly non-restricted areas, supposing two-wheeled modes more dangerous than cars. On the contrary, a comparison of the accident rates at a city-level before and after implementation showed a reduction of almost 50% (fatalities reduced from 115.3/106 inh. in 2002, to 65.3 deaths/106 inh. in 2005).

Pedestrianization means to gain space from cars in favour to vulnerables users. Such an increase of pedestrian space was quantitatively assessed in 280,000 sqm converted during the 2001 - 2004 period (in 2001 they were 235,023 sqm); from Figure 1 it is easy to that the goal to reduce the road space for cars inside the LTZ by 2% is fully overcome, being achieved the result of 20% increase of space for pedestrians. Indeed the creation of the car-free network means not only the creation of pedestrian areas but also the enlargement of sidewalks and the removal of parking lots. This process is also “magnified” by the provision of aids for physically-challenged people; indeed, virtually all the pedestrian paths are equipped with ramps for wheelchair users and with tactile tiles for visually impaired people.

b) General Outcomes

At general level, the implementation of pedestrianization schemes cannot be separated, in terms of consequences on the environment, transport and society, from what achieved thanks to the 5.1 measures. For this reason, same results stressed in sections M11 of templates 5.1 a and b are valid in this case too. For the reader's ease only the main table is reported; for general comments please see sections M11 of templates 5.1 a and b.

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WP 5. 2 pedestrianization								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.2/Econ.1.a	2	Cost for operating the infrastructure (€/inh) referred all city pop.	2507,63				0,34**	No variations foreseen for frozen and trend scenarios **Value referred implemented measure
R5.2/Econ.2.a		cost for maintenance of infrastructure (€/inh) referred all city pop.	72,15				0,10 **	No variations foreseen for frozen and trend scenarios **Value referred implemented measure
R5.2/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)		1) 0,9 2) 0,1	1) 0,9 2) 0,1	1) 0,8 2) 0,1	0,65	1)private car 2)PT
R5.2/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)		1) 1,1 2) 3,8	1) 1,1 2) 3,8	1) 1,0 2) 3,8	0,53	1)private car 2)PT
R5.2/Env.1.a		polluting vehicles (no of polluting vehicles)	1)868.720 2)441.110 3)64.796	a)465829 b)366923 c)1219910 d)101564 e)2536	a)399728 b)35686 c)163015 d)158338 e)2536	a)397834 b)353689 c)163804 d)156311 e)2573	1)550.319 2)242.140 3)42.435	The figure are referring to whole city and to: 1)Not cat cars; 2)Not cat 2-wheels; 3)Not cat comm. a)Gazoline car<1,4t b)Gazoline car>1,4t c)Diesel car <1,4 t d)Diesel car >1,4 t e)Buses
R5.2/Env.2.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R5.2/Env.2.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city

Table 2- ex-ante (with exclusion of do something scenario) and ex-post results in Rome

MEASURE-LEVEL RESULTS

Measure title: Implementation of pedestrian areas

Project: MIRACLES

Measure number: 5.2.a

City: Rome

WP 5.2 pedestrianization								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.2/Env.2.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R5.2/Env.3.a	5	concentrations of CO (millig/m ³)	1.77			No direct data available See table 2	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stat) (***)
R5.2/Env.3.b	6	concentrations of particulates (microg/m ³)	50.0				44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***)
R5.2/Env.3.c		concentrations of C6H6 (microg/m ³)	1)8,75 2)12,3 LA-H 6,8 LA – B 8,6 C				1)5.55 2)7.2 LA-H 4.8 LA-B 5,2 C 4,9 TR 6,4 S 4,1 T	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***) 2) Measured value by passive samplers method (**)

(**) Mean normalised value of all the 51 monitored locations in the Rail Ring Area (12 at LTZ, 7 at Trastevere, 4 at San Lorenzo, 5 at Tridente)

(***) The values of Villa Ada stations are not considered due to its use for the characterisation of the background air quality status of the city.

LA: Laboratory Area (H- Hot spot, B- background); C: ZTL, TR: Trastevere, S: San Lorenzo, T: Tridente

WP 5.2 pedestrianization								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.2/Soc.1.a	13	awareness (%)	90				89	
R5.2/Soc.2.a		Satisfaction level (Lickert scale point 1 to 5)	3.88				3.27	

Table 3- ex-ante (with exclusion of do something scenario) and ex-post results in Rome (cont.)

MEASURE-LEVEL RESULTS

Measure title: Implementation of pedestrian areas

Project: MIRACLES

Measure number: 5.2.a

City: Rome

WP 5.2 pedestrianization								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.2/Tran.1.a	21/22	modal split (motorized and non motorized) (%) of the total flow)	1) a)20 b)48 c)11 d)21 2) a)30 b)27 c)23 d)20	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 22 b)+c) 53 d) 25	1) a) 18 b) 47 c) 8 d) 27 2) a) 31 b) 22 c) 24 d) 23	1) whole city 2) Rail Ring Area a) PT b) Priv 4-wheels c) Priv 2-wheels d) Walking
R5.2/Tran.1.b	21/22	traffic levels (trips day per vehicle)	2,2	2,5	2,5	2,5	2,5	
R5.2/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42*	1)4.8 2)1,53	1)4.8 2)1,53	1)4,9 2)1,55*	1)6,1 2)1,5	1)whole city 2)Rail Ring Area
R5.2/Tran.2.a		Number of fatalities (deaths/10 ⁶ inh)	115,29				65,33	No variations foreseen for frozen and trend scenarios Base year and Ex-post value referred to whole city
R5.2/Tran.3.a		Routes (no.)	2				5 electric + 1trolley	No variations foreseen for frozen and trend scenarios
R5.2/Tran.3.b		Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				40' electric buses 55' trolleybus (+6 min. stop at the line terminal) duty time: 5.30-24.30	No variations foreseen for frozen and trend scenarios
R5.2/Tran.3.c		travelled people (no.)	16000/17000		15944/16941	16167/17178	10000/12000 pax/day electric buses 32000 pax/day trolleybus	

* Data provided by local partners; ** ITEMS Data or elaborated from ITEMS Results

Table3- ex-ante (with exclusion of do something scenario) and ex-post results in Rome (cont.)

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) reduce the road space for cars inside the LTZ by 2%	Conversion into pedestrian areas of: TRIDENTE (12 hours per day) D2 Zone, Piazza dell'Orologio, Piazza del Parlamento, other minor zones	<i>Increase from 235.023 in 2001 to beyond 280.000 sqm in 2004: about 20% increase.</i>	☺☺☺
2) Raise citizen awareness by 10% in specific areas inside the Laboratory areas	Awareness level did not appreciable variations (from 90% - baseline value to 89% ex post value)		☹

Caption

☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level

☹ difficult to assess ☹ not achieved

Status of the Measure beyond MIRACLES and Upscaling

The measure (including all the subtasks) is going to be completed with further improvements and it will continue beyond MIRACLES. For what concern pedestrianisation, the measure can easily be up-scaled in selected areas in the whole city; this is an on-going process which started in Rome since the '70s, even though not in a

MEASURE-LEVEL RESULTS

Measure title: Implementation of pedestrian areas

Project: MIRACLES

Measure number: 5.2.a

City: Rome

systematic way.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The reduction of transport-related negative externalities, as traffic congestion, poor air quality and excessive noise levels, and growing energy consumption, is a clear challenge for the European authorities at all levels. Initiatives have been carried out in recent past – and are a clear priority for the upcoming future – to tackle these problems promoting a modal split from private to sustainable transport modes; major emphasis has been given to urban areas, where negative transport externalities affect citizens life quality. In response to these serious and increasing problems the European Commission, within the fifth Framework Programme for Research and Development, launched the CIVITAS Initiative in order to support effective and innovative measures to improve urban transport. The MIRACLES Project (Multi Initiative for Rationalised Accessibility and Clean Liveable Environments) is part of this Initiatives and involves Rome besides other major European cities.

The integrated approach defined within the Project seems to be the right key to manage mobility policy at city level. Our experience in coping with the problem of reducing the private demand in the city centre says that can be successful. For example, only few years ago, Piazza Del Popolo was used for parking only. And now, it's a real area given back to the citizens.



Figure 10: Piazza del Popolo – a pedestrian area given back to the citizens

M13: Interrelationships with other measures

This measure is strongly linked to Task 5.1 and the awareness raising aspects of WP10.

M14: Lessons learned

What has been already successfully implemented since 1994, the “chain” land use, transport planning, ITS traffic management, environmental impacts evaluation, is in place to take decision on the mobility issues.

Flexibility and technology, it's a way for coping with the new demand and so, even measures like the access control system can be made acceptable to the population provided that there is a strong communication way and enough flexibility of management.

The establishment of new access gates, the extension to Trastevere district of the ACS, are permitting to cover the whole LTZ, creating within MIRACLES the more extended access control system in Europe, where only London access control Zone can be compared with the already in place and planned system of Central Rome.

The results expected by the implementation of the actions above explained were carrying out a reduction of peak hour traffic in the laboratory area, a decrease of polluting vehicles number in the LTZ, a reduction of illegal entrances in the LTZ and in turning modal split towards sustainable modes (eco-bus and walking).

What is unexpected is the modified approach of people towards their city, in fact in the process of “participated democracy” before the definitive approval of the plan, the pedestrian mode is privileged especially in the city Centre, introducing for the first time the concept of “environmental island”, where inside the maximum speed will be limited to 30 km/h and where the bicycle mode will be favoured.

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5. Measure 5.2b – Urban Traffic Plans

MEASURE-LEVEL RESULTS	
Measure title: Set up of green corridors and green area	Project: MIRACLES
Measure number: 5.2b – Urban Traffic Plans (LUTP)	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>The measure applies to an area included in the northern portion of the Laboratory Area (2nd District) and it aims at implementing, according to the General Urban Traffic Plan, the following:</p> <ul style="list-style-type: none"> ○ Interventions in individual neighbourhoods, which can bring in the short term period (1-3 years) visible and measurable benefits in mobility conditions: their name is Local Urban Traffic Plan (LUTP – PUT in Italian Language). ○ modifications to road sections and crossings in order to better distribute existing space between the different road users' categories 	
M2: Measure description:	
<p>The intervention developed within the Urban Traffic Plans – LUTPs - can be divided into two categories: quantitative and qualitative intervention.</p> <p>For the former, the measure developed aims at re-organizing traffic circulation optimizing existing infrastructures in order to reduce pollution and traffic congestion, and to increase road safety.</p> <p>The latter, also considers the impact of a specific intervention on life quality; e.g. the impact on pedestrians, cyclists and environment (architectural impact).</p> <p>The Plans are firstly discussed and approved by the District Council. After that, the whole intervention plan was approved by Executive Committee Decision on 28/10/03, no. 633. The approved projects are considered preliminary projects and the further levels of design, according to Italian legislation, will be drafted in following specific acts that will allow the implementation of the measures include in the plans. All intervention foreseen for District II have already been approved, up to the definitive plans, by the City Council with the Executive Committee Discussion n°639 (28/10/2003).</p> <p>Inside the Miracles Laboratory Area (MLA) special attention was given to the 2nd District, an area of 1,366 ha. Inside the 2nd District two critical areas have been identified after a critical analysis:</p> <ul style="list-style-type: none"> - Largo Forano, located in the north-east corner inside the LA. - Viale Maresciallo Pilsudski, located in the northern part of the Laboratory Area. It is an important corridor linking the residential zone of Parioli with the Auditorium area and the Rail Ring as well as with the river axes (LungoTevere). <p>Funds to implement specific intervention in the first two critical areas identified within the study have already been allocated by the administrative City Council's office within the same Act, where Miracles funds were considered for the design and to follow the project implementation.</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The implementation of the General Traffic Master Plan of the City (in Italy called PGTU) includes the Local Urban Traffic Plans (LUTPs) that are small interventions in individual neighbourhoods with the aim is to rationalise the existing resources; LUTPs do not, therefore, involve new infrastructure, but tend to use a range of instruments regarding traffic regulation, urban redevelopment, upgrade and adaptation of existing roads and pavements. Compared to infrastructural interventions these measures are simpler, less time-consuming and cost less.</p> <p>This new tools was never tested before in an integrated context like the PGTU of a large city like Rome. New road distributions, with narrow carriageways and re-organised parking, providing dedicated lanes for motorised vehicles, bicycles and pedestrians is to be established in the II District, inducing safe and smooth low speed traffic, and strongly discouraging illegal behaviours.</p> <p>The attempt is to bring in the short term period (1-3 years) visible and measurable benefits to bear on road safety, the accessibility and liveability of pedestrian areas, levels of acoustic and air pollution, and traffic flow.</p>	
M4: Situation before CIVITAS:	
<p>No in depth analyses had been performed before MIRACLES concerning all the aspects tackled by this measure, such as large scale intervention putting in safety the pedestrian crossings and the road intersections including also demolition of the architectural barriers widening and profiling of the sidewalks, etc.</p> <p>In the 2nd District the two selected areas were places of a lot of mobility problems. In particular the previous parking system in Viale Pilsudski (herringbone parking under the trees) was unsuitable, and the visibility was very bad for drivers coming out of parking spaces onto the road. Moreover high traffic flows were not well regulated. A traffic circulation plan was missing. Better details are given in M5.</p>	

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

Project: MIRACLES

Measure number: 5.2b – Urban Traffic Plans (LUTP)

City: Rome

M5: Design of the measure:

LUTPs are intervention putting in safety the pedestrian crossings and the road intersections including also widening and profiling of the sidewalks, insertion of islands divider, new pavement of sidewalk areas, demolition of the architectural barriers, remaking of the layer of usury of the flooring, retraining of the areas of intervention, remaking of the road system of signs as well as the insertion of urban furnishing.

The complex job carried out in LUTPs is developed through a number of phases that depart from the analysis of the state of the art, determination of the critical areas and identification of the interventions with submission of final Design to be put on tenders for their implementation. In the 2nd District, two main areas were selected for the first implementation.

A) Largo Forano

Largo Forano, is located in the north-east corner inside the LA (see figure 1 for details)



Figure 1: The position of Largo Forano in the context of the II District

The main problem here is the approach road to the node in Via Vessella, the stop line of which is too far back from the intersection proper and from the traffic islands. Moreover, cars parked at the intersection are a serious hindrance to traffic and pedestrians.

The solution, implemented within the MIRACLES project and represented in the following picture, is to move the stop line in Via Vessella up to the node, create a pedestrian island and increase the width of the pavement on the Viale Somalia side of the road.

A pedestrian crossing is to be situated in Viale Somalia, and the traffic islands in Via M. Sabina are to be made good. The reorganization of this node will not only benefit the safety of pedestrians, but by decreasing the distance between the node and the stop line will reduce waiting time at the traffic lights.



Figure 2: Largo Forano before (left) and after (right)

B) Viale Maresciallo Pilsudski

Viale Maresciallo Pilsudski is located in the northern part of the Laboratory Area. It is an important corridor linking the residential zone of Parioli with the the Rail Ring Road as well as with the river axes. Although traffic in this area is not particularly intense it becomes increasingly congested during the day and due to the presence of shops there is an increasing demand for parking. In the following figure, in yellow is highlighted the intervention

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

Project: MIRACLES

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City: Rome

area – about one kilometre of length



Figure 3: The position of Viale Maresciallo Pilsudski in the context of the II District

Within MIRACLES a new traffic plan has introduced the two-ways traffic in Viale Pilsudski, with two lanes in each direction, a right-hand lane 3.50 m wide and an inside lane 3 m wide.

A new parking system was therefore proposed that involves putting in an access lane between the trees and the road, and having cars park parallel to the road on both sides of the access lane.

The new traffic and parking arrangements have made it necessary to move one of the two bus stops on Viale Pilsudski.

In the following picture is shown part of the final design, highlighting the new traffic regulation in the initial and final part of the intervention.

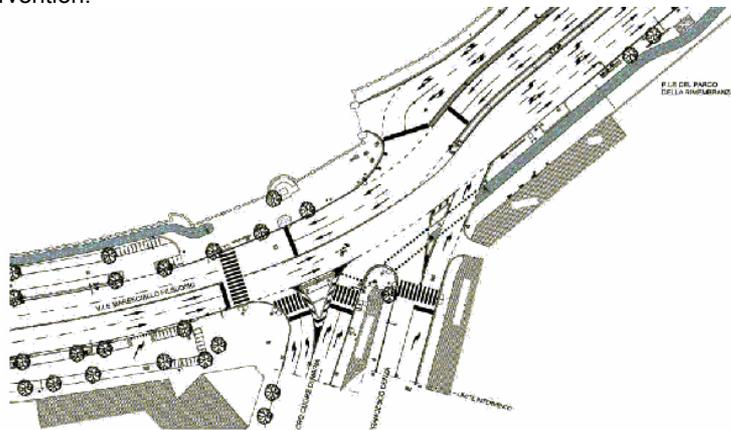


Figure 4: LUTP design in Viale Maresciallo Pilsudski

The intervention foreseen for District II have already been approved, up to the definitive plans, by the City Council with the Executive Committee Discussion n°639 (28/10/2003) and that funds to implement this measures (Euro 1.530.276,11) have been allocated by the administrative City Council's office with the same act.

The Municipality prepared also a leaflet (see following figure) distributed to the citizens in order to inform them about the LUTPs in the II District and to increase their awareness.

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

Project: MIRACLES

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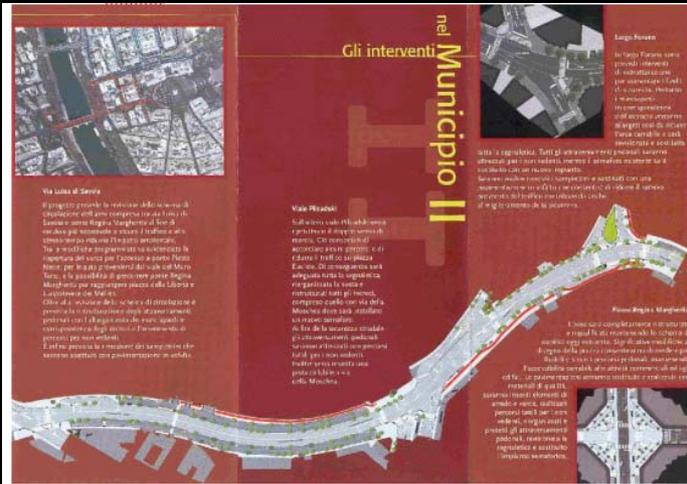


Figure 5: Leaflet with the LUTPs in II District

M6: Actual implementation:

According to the Executive Committee Discussion n°639 (28/10/2003), the duration of the civil work has been considered of 256 natural consecutive days from the delivery of the areas.

A following Traffic Decision provision approved the executive project. On that basis, the relative competitive bidding was carried out, assigned in September 2005.

From October 2005 the implementation works have started for Viale Pilsudski, where conclusion was reached just after the end of Miracles. In the following images, the civil works in October 2005 are reported.



Figure 6: Status of the implementation works in Viale Pilsudski – October 2005

In Largo Forano, the start of implementation works was in March 2006 with conclusion expected within September 2006.

M7: Deviations from the plan:

No deviation from original Plans.

Indicators – Deviation from what planned in deliverable 4.1

Since the measure was enforced during the conclusion of Miracles, indicators were used to define only a baseline scenario, common to measure 5.2a

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Methods of measurements in the “before” (ex ante) phase were those already applied for the other measures of WP5. See related templates for any details. Besides, the measure is in the implementation phase, thus ex-post analysis are planned in the final part of 2006, once completed the construction works.

M9: Achievement of quantifiable targets:

The measure need Municipality investments for the implementation of the LUTPs, in order to show in the short term period (1-3 years) visible and measurable benefits in mobility conditions, to be measured in terms of

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

Project: MIRACLES

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City: Rome

improvements of traffic flow conditions as well as in terms of local improvements of the distribution of the existing space between the different road users' categories.

Since the measure benefits are in the making, improvements cannot be quantified.

M10: Achievement of evaluation-related milestones:

Being not consolidated results, but scenarios results only, it was not possible to perform real ex ante/ex post comparisons

M3: Implementation of Viale Pilsudski and Largo Forano Urban Traffic Plans: 2004/2005. Civil works currently running. Completion expected within September 2006.

M11: Report on the measure results:

Being the measure in progress, this paragraph is dedicated to the do something scenario, also called Miracles Scenario. For a general baseline situation, please refer to measure 5.2.a template, section M11.

The Miracles scenario

The effects of the LUTP realisations were evaluated from the point of view of transport and environmental (noise and air quality), both on whole II District territory. Such necessity derived from the fact that the interventions were planned to modify noticeably the distribution and the quantities of the vehicular flows on the road local network, therefore their environmental impact.

The evaluations of traffic flows and environmental quality included in the main LUTP prompted changes to the scheme of circulation, decrease of the congestion in main axes, improvement and simplification of intersections, moderation of the speed.

The evaluations of traffic were carried out by the micro simulator Vissim that allows to appraise the design hypotheses along with details of the users behaviour, simulating the real conditions of operation considering traffic lights, road sections, special requirements coming from public transport and obstacles due to the illegal parking, etc.. The environmental evaluations were carried out with suitable algorithms applied to the results of the simulations of traffic: for the issues of pollutants in atmosphere the consequential emission factors were calculated using the methodology COPERT, while for acoustic parameters the so-called "Santoboni" formula was applied.

The simulation scenarios

Two scenarios have been taken into account for the simulation: "without" and "with" the measure. Both simulation scenarios were referred to the morning peak hour.

The simulation results

In table 4 ("with" II District LUTPs – end of the whole LUTP plan) simulation results are presented, in terms of differences in air quality emissions. In table 3, total time flows for each section are reported both for without and with scenarios. A general saving of the time spent on the II Districts pathways could be assessed.

VIA PANAMA - VIA SIACCI	676	225
VIA PANAMA - VIA ROSSINI	640	257
VIA SIACCI - VIA ROSSINI	161	155
VIALE PARIOLI - VIA ROSSINI	361	88
VIALE LIEGI - VIA SIACCI	277	135
VIALE PARIOLI - VIALE LIEGI	239	202

Table 3 – Time flows in II District itineraries respectively without and with LUTPs

CO	14,8	13,2	-2	-10,9%
NOx	0,7	0,8	0	5,2%
COV	2,6	2,4	0	-7,8%
PM	0,0	0,0	0	-4,2%
Benzene	0,1	0,1	0	-8,1%
CO2	222,6	205,9	-17	-7,5%
fuel	70,3	65,0	-5	-7,5%

Table 4- Variation of impacts in a II District site respectively without and with LUTPs

Due to the late implementation of this measure, outcomes from are difficult to assess. However, some initial conclusions could be drawn. This measure is based on minor infrastructural modifications and is an example of how the larger problems of safety and pollution can be tackled by starting from a bottom-up approach. This is

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

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City: Rome

particularly important for a city such as Rome where, until only a few years ago, most decisions on traffic were made at city level and according to general regulatory directions.

Status of the Measure beyond MIRACLES and Upscaling

The measure is going to be completed and will continue beyond MIRACLES.

If the measure will be successful as expected, the LUTP can easily be up-scaled in selected areas in the whole city. Anyway, the City Council already approved other LUTPs both in the 2nd District as well as in other Districts. X and XV Districts are currently starting their LUTPs and benefits are expected also in peripheral areas of the city.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The approval of the Urban General Traffic Plan (PGTU) in Rome (of the. C.C. N. 86 of June 26th 1999) has started a series of realizations in the sector of mobility of which the activation of traffic centre located in STA with the centralisation of all the connected systems (centralization of the traffic lights, monitoring of the traffic on the principal itineraries, system of video surveillance, electronic gates in the city centre) have represented the most advanced point.

With the activation of the implementation plans of the PGTU (Local Urban Traffic Plans – LUTPs), the action of rearranging can be widened to the whole territory in a planned and co-ordinated form.

These tools are set, in fact, like a moment of synthesis among the macro planning of the traffic to city level (PGTU) and the planning of detail of the spaces devoted to the mobility in the single districts, interesting both the competencies proper of the traffic planning and those typical of the urban architecture.

Inside the Plans, the opportunities offered by the different tools can be exploited with the possibility, for every zone &/o District, to define a general and exhaustive picture of the current state of the mobility offer and mobility demand, individualising the priorities of intervention inside a coherent system of general objectives, among which the road safety and the environmental retraining are the principals. The typologies of intervention of simple realisation characterised by reduced costs, if compared with those for infrastructural interventions, quick times and low complexity of realisation.

The LUTPs have then the possibility, through opportune channels of information and with mechanisms of participated planning, to have a direct intervention of the citizens in the resolution of the problems of accessibility and liveability of their own districts.



Figure 7: Road sign for the LUTP works in Viale Pilsudski

The LUTPs haven't to be underestimated in terms of effects, since they can have a meaningful impact on the mobility of the districts in safety terms, fluidity of the traffic flows, retraining of the spaces and, above all, protection of the weak users. They contribute in synthesis to improve the liveability of the urban environment often giving solution to the daily and visible problem list expressed by the citizens.

The LUTPs constitute the tools that individualise strategies for interventions in the specific District to be effective

MEASURE-LEVEL RESULTS

Measure title: Set up of green corridors and green area

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City: Rome

in the next 2-3 years.

M13: Interrelationships with other measures

This measure is strongly linked to Task 5.1 and the awareness raising aspects of WP10.

M14: Lessons learned

LUTPs are predominantly finalised to the improvement of the urban system of circulation through a correct planning and an optimal management of the existing spaces for the reduction of the levels of pollution, the reduction of the accidents, a greater equilibrium among the components of the traffic and the improvement of the conditions of circulation tied to the fluidity of the traffic.

In the actual situation, the LUTPs should allow the balance of the functions and favour the accessibility of the road surface from the weakest categories (children, pedestrians, bicyclists), adopting those strategies and contemplate priority technical choices devoted to the recovery of the urban function of the road and to the development of the pedestrian mode.

The objective of LUTP projects is the necessity to make the use of the roads simple and attractive for those categories until now excluded or limited in this use. In the activities of executive planning it will be therefore necessary, coherently with the design choices regarding the use of the spaces, to foresee the employment of elements of urban furnishing of quality including floorings, underlining a different relationship among pedestrian and cars, and the urban green, also as protection from the vehicular traffic.

LUTP interventions should be finalised to the recovery of superior levels of quality of life, with a formulation of strategies and interventions that also has the purpose to improve the environmental quality and the visual impact of the urban territory so that to raise the level of acceptance and satisfaction from the citizens with particular attention to the use of the public spaces from the weak categories.

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6. Measure 6.1 - Time based Road Pricing

MEASURE-LEVEL RESULTS	
Measure title: Integrated Pricing Strategies	Project: MIRACLES
Measure number: 6.1 Time based Road Pricing	City: Rome
The Measure – what is it about?	
M1: Measure objectives:	
<p>The Measure objective is focused on the Central LTZ and concerns the following performances:</p> <ul style="list-style-type: none"> ○ to study the adaptations to the Automatic Access Control System and Road Pricing policy in place (ACS+RP) to introduce a night access restriction scheme; ○ Perform a feasibility study on a Road Pricing policy for tourist coaches; ○ Analyse the Best Available Technology to automatically detect the two wheeler in order to control their entering the Central LTZ. 	
M2: Measure description:	
<p>The following activities have been performed:</p> <p>a. Set-up of the full set of activities able to introduce the evening access restrictions policy;</p> <p>The full scale Access Control System and flat fare Road Pricing scheme (ACS+RP), applied in the Limited Traffic Zone (LTZ), is operational since October 1st, 2001.</p> <p>The comparison of the access demand's esteem during the restriction period in the period between before and after the introduction of the Automatic Access Control System in Rome, a 20% of the vehicular flow.</p> <p>The morning traffic peak is lower than in the past, while the evening one is the highest of the day and slightly higher than before the activation of the gates. A peak of transits after the switch-off of the present system at 6pm has been observed and specific surveys showed that part of the evening traffic flow is just crossing the zone. Furthermore, increasing night traffic is observed during the weekends, with great problems for the residents and tourists.</p> <p>Simulations have been performed in order to assess and to model the effects of a road pricing scheme application in the evening hours (from 6pm until to 11 pm and from 11pm until 3am).</p> <p>In order to face and reduce the problem of late evening congestion, a careful analysis of all the transport data and of the possible schemes, including pure road pricing in the evening and night period were performed, for a large scale application of the chosen policy.</p> <p>b. Feasibility study for the introduction of specific road pricing policies with per-time analysis, dedicated to tourism bus coach category, already subject to ticket payment to access the city centre ("<i>RP schemes for Tourist Coach</i>");</p> <p>c. Analysis of the Best Available Technology to monitor and detect motorbikes and motorcycles, based on the future asset of access regulation for two-wheels ("<i>Choice of BAT for 2-wheels control</i>").</p> <p>Another result concerns in fact the 20% increase of two wheels access (and a 6% increase of public transport). The increased use of the scooters, not limited by any policy but among the most polluting vehicles (mopeds specially) has to be monitored and limited, if a technological choice could permit their plate recognition.</p>	
The Implementation – how was the measure implemented?	
M3: Innovative aspects:	
<p>The introduction of the ACS+RP scheme in the city centre of Rome was producing a large set of positive results in terms of reduction of congestion but the environmental effect were limited by unexpected problems, i.e. the increase of evening/night traffic flows, the increase in use of scooter, and the limited control on highly pollutant special fleets.</p> <p>The innovative aspects are in general to find new deviations from the adopted scheme, anyway successful and accepted by Roman citizens, in order to reduce its negative impacts. It's very important to be able to accept deviations from was initially expected, because the real process in a city like Rome can differ from standard cases in more limited environments; besides, the road pricing schemes in urban cases are something of new, whose effects are still to be deeply investigated.</p> <p>a. Evening and night schemes</p> <p>The introduction of road pricing policies in extensive way after the simulations was made in completed (CAPITALS PLUS, EuROPrice, PRoGR€SS) EU Projects; anyway, the real case of Rome need careful analysis of the collected data before selecting the right scheme. The innovation is the selection of the right mixture of access limitation / road pricing able to match the Municipality requirements in terms of reduction in</p>	

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traffic congestion and in pollution levels.

a. Evening and night schemes

The innovation is the selection of the right mixture of access limitation / road pricing able to match the Municipality requirements in terms of reduction in traffic congestion and in pollution levels.

b. RP schemes for Tourist Coach

Rome LTZ (inside ZTL1) is controlled by the the ACS+RP scheme: the coach can be detected when they access this zone but, after this check, they can use the urban space independently from the permit they bought: a more dedicated control is needed.

On the other hand, there is an interest by the Coach Drivers to be informed on the traffic situation along their path and, in some cases, to be driven by a turn-by-turn navigator application. Rome is taking advantage of the results gained through the participation to the CAPITAL ITTS EU project, aiming to integrate on a common and standard platform tourism and transport information, to ensure coach management with route guidance and parking availability information and by providing traffic, tourism and proximity information.

c. BAT technology to control 2-wheels vehicles in Central LTZ

Identification of the best available technology to detected 2 wheels access in the LTS; this represent a very innovative step since, up to now, no system like that has been implemented in Italy and in Europe.

M4: Situation before CIVITAS:

1. The Automatic Access Control System

The ACS (22 electronic entrance gates) has been installed in Rome on 1st Oct 2001 combined with a flat flare RP scheme to limit private vehicles accesses to the Limited Traffic Zone (LTZ) and to enforce control measures to face unauthorised accesses. (in operation from 6.30 am to 6.00 pm in the working days and from 2 pm to 6 pm on Saturdays)

The system allows the access only to residents and to other specific categories (e.g. disabled persons, doctors, police authorities, ambulances, etc.), in some cases (stakeholders in with shops located inside the restricted area) access is allowed by paying a yearly fare. From a technological point of view, the whole system is composed by a control room and two sub-systems located at the gates: an ANPR system automatically detecting plates via OCRs and a DSRC system, permitting the use of suitable On-Board Unit (OBU) to verify vehicles' permit recognition. This mixed ACS+RP scheme, keeps the asset of permits distribution and fares structure among all users categories at present authorised.

About 30,000 on-Board Units have been distributed to LTZ residents allowing accesses and parking payment through smart-card technology. "White lists" for specific categories of permit holders have been settled up to allow dynamic management of the automated access control system.

Different road pricing schemes were assessed and compared during the PRoGRESS project, as well as the socio-economic acceptability of such schemes. The simulations results showed that, in general terms, the substitution of the current scheme, based on the annual fare system, with a per-trip or time-based scheme (assumed that the access restriction is still operational) would not lead to substantial changes in terms of overall modal split. This is due to the fact that a large part of the vehicles currently accessing the LTZ during the restricted period is constituted by taxis, police, services, good vehicles, i.e. vehicles that will not be charged after the road pricing scheme introduction. It means that only a relatively small number of the vehicles currently accessing the area are considered as "subject to charges". Due to private traffic pressure towards the city centre, the passage towards a pure road pricing strategy like London is unfair, due to the obligations to apply an absolutely inadequate fare to maintain the same modal split.

a. Evening and night scheme choice

On the other hand, the data collected have shown (see following figures) a peak of traffic flows towards LTZ after the 6 pm when the system is switched off.

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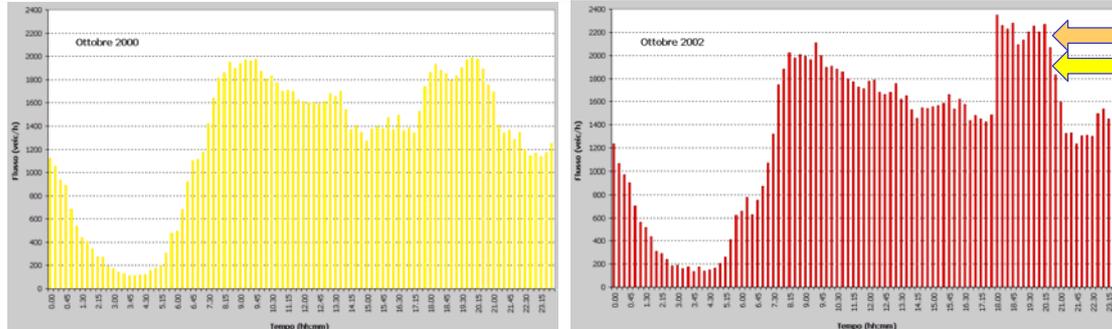


Figure 1 – The peak in LTZ evening flows

A second wave of simulation activities was then performed, aiming at assessing the effects of a road pricing scheme application in the evening period (from 6pm to 11pm).

Within this phase two different scenarios were analysed: the “morning/afternoon” and the “evening” scenario:

- in the first one, only selected groups of car drivers (residents, authorised car drivers and public utility vehicles) are allowed to access the area, while in the second one the access is completely free;
- as a consequence of the previous item, in the evening hours a quite large set of car drivers just cross the area;

in the morning/afternoon hours systematic trips are prevailing, while in the evening period most of the trips are for leisure or for purchase purposes.

b. RP schemes for Tourist Coach

Before MIRACLES, the Coach Management Plan was carried out in Rome with the emission of a complex series of paper permit. To control the respect of the Plan's rules is carried out by Urban Police but due to high number of coaches and to city centre dimension the number of violations detected is very limited and difficult to be prosecuted.

In occasion of the Jubilee in 2000, measures have already been implemented to prevent a “break-down” of the traffic network. (while in 1998, 14.1 million tourists visited Rome, in 2000 25.5 million visitors came to Rome).

The measures taken to cope with the transportation demand during the Jubilee year in Rome based on 2 pillars: access restrictions for buses combined with provision of extra parking lots, and additional bus lines.

The inner city was restricted in access for buses. Buses had to check-in at a check point, where they were assigned free parking lots closest to their destination and received guidance to get there. The parking lots could be reserved in advance. Buses were only allowed to enter the inner city area in order to pick up guests at hotels in case they had a permit.

c. Choice of BAT for 2-wheels control

Before Miracles, there was no system implemented to detect 2 wheels at LTZ's electronic gates.

M5: Design of the measure:

a. Evening and night central scheme Analysis

As already mentioned, a peak of transits towards LTZ is observed after the electronic gates are switched off.

Simulation results of the evening road pricing scheme carried out during the ProGRESS Project and the first years of MIRACLES, either in summer and in winter period, shows that user reaction to the pricing policy is strictly related to their trip reason: drivers with a destination inside the LTZ are less subject to the fare than drivers crossing the LTZ to reach a destination located outside the area.

These results have been stressed by the simulation analysis carried out on both drivers' categories; the analysis focused on three different scenarios (scenario 0 is the current situation) characterized as follow:

scenario 1: a 1€ fare is assumed;

scenario 2: a 3€ fare and a 20% Public Transport improvement (in terms of travel time reduction) is assumed;

scenario 3: a 6€ fare and a 20% Public Transport improvement (in terms of travel time reduction) is assumed.

Next picture shows, for drivers with destination located inside the LTZ, their reaction to the implementation of pricing policies during the evening period, simulated during ProGRESS project in 2002. It is observed that the percentage of private car users gets smaller increasing the accessing fare and that it is balanced by the increase of two wheels and PT users. Just a small percentage (around 5%) will change the trip destination and an even

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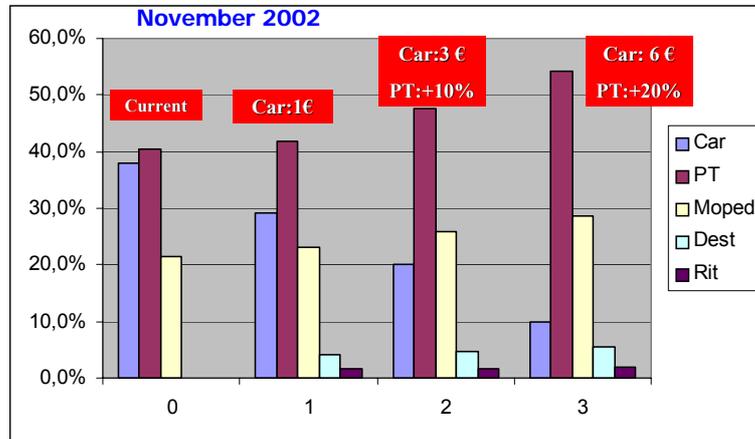
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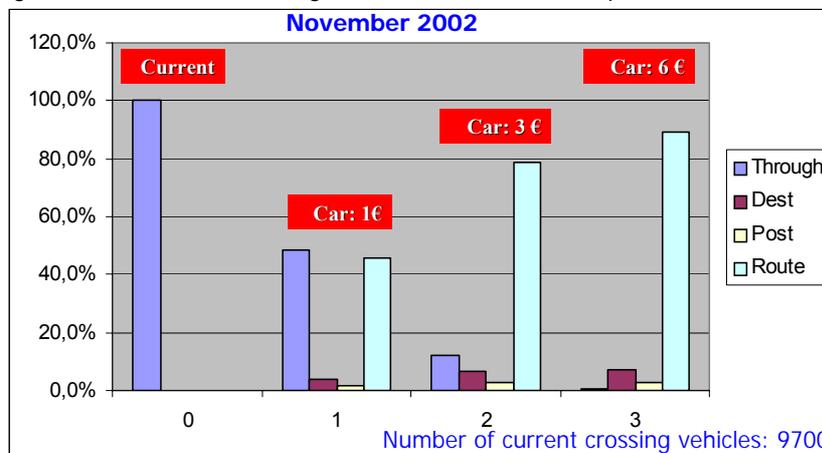
smaller percentage will postpone his trip.



Current numbers of users: 62.060 (18.850 cars)

Figure 2 – Reaction to simulated evening road pricing scheme - drivers with destination Central LTZ

The following figure shows, for drivers crossing the LTZ to reach a destination located outside the LTZ, their reaction to the implementation of pricing policies during the evening period. It can be seen that this category is more subject to the pricing policies. In fact, more than 50% of user no longer cross the LTZ even with a 1 € fare and this percentage increase at the increasing of the fare: with a 6€ it drops almost to zero.



Number of current crossing vehicles: 9700

Figure 3 – Reaction to simulated evening road pricing scheme for drivers crossing Central LTZ

Detailed results are reported in the “Ex-ante Working Note” accessible at the restricted area of MIRACLES website.

The simulations carried out thus show that the implementation of an evening road pricing scheme could produce a remarkable traffic congestion and pollution reduction in the LTZ. According to this, the original plan was to carry out a demonstration case with a limited number of volunteers and, if positive results should have confirmed, then to implement a full-scale RP scheme, with all citizens paying for accessing the LTZ in the evening period.

On the other hand, analysis carried out by the specific structure in ATAC dealing with the evolution of mobility process inside the city, the so-called “Mobility Observatory”, showed that the measure of traffic limitation in the LTZ historical downtown and the activation of electronic gates has led to a reduction of the traffic flow in the complete day and not only in the restriction hours.

This process is still in course but the trend shown from years 2001-2004 and brought back in the next figure, which points out a substantial stabilisation of the flows in the period of prohibition, **has a continuous, even**

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though slow, lessening of the flows in the hour bands not included into the limitation's measure.

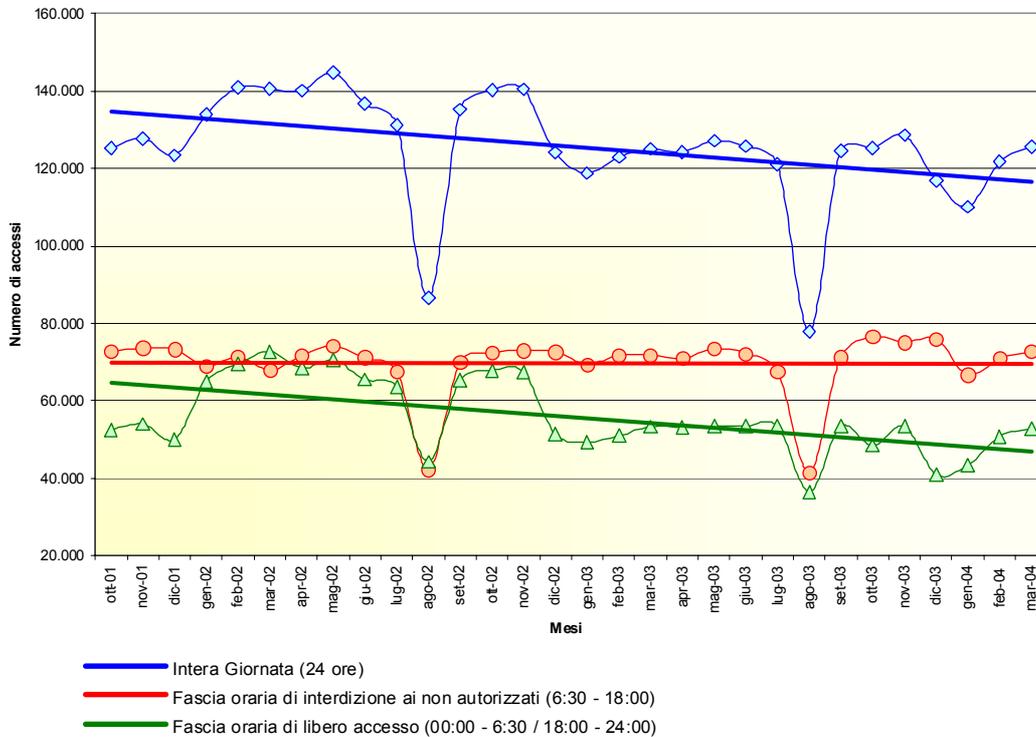


Figure 4: Vehicular average accesses for hour band (October 2001-March 2004)

The previous picture shows that the traffic flows in the central LTZ are around 78.000 vehicles per working day, while in the period outside the limitation the traffic flow is passed from a mean of 62.000 vehicles to about 45.000 with a reduction of 25% in the 4-years period.

Hence, a new limitation to be applied to cars in the evenings appeared difficult to be accepted by the citizens. According to the Municipality aim, expressed by the Decision 1168/05, the implementation of such evening RP scheme on large scale will happen only in case of high environmental emergency where the health issue become predominant.

On the other hand, **traffic flow during the weekend nights is very high**. The evening congestion and the pressure of non-systematic travel towards the city central areas for leisure is a constant phenomena in the whole city centre of Rome.

In 2005, the Municipality thus decided to carry out an experimentation tied to the summer period in the hours from the 11pm to 03,00 am from Friday to Saturday from 17th June until 10th August and from 20th August till 17th September.

The new "Night Central LTZ" has a perimeter that goes from Piazzale Flaminio to via del Corso, Piazza Venezia via del Teatro Marcello and Lungotevere: a reduced version the actual diurnal ZTL, with the use of passages electronic of via Ferdinando di Savoia, Bridge of Ripetta, via Tomacelli, Ripetta, Zanardelli, via Panico, corso Vittorio Emanuele II, via dei Fiorentini, via San Filippo Neri, via Giulia, via Arenula, via del teatr o Marcello, via Crispi-via Ludovisi.

In the first weeks, in order to guarantee the correct information to the motorists, the twenty points of accesses have been watched by agents of the Municipal Police, then 13 accesses have been controlled by electronic passages and seven accesses have been controlled by the police.

After the positive experimental phase the new "**Night Central LTZ**" has been officially introduced as a structural measure during all the weekend nights as from **October 6th 2005** is depicted below; it smaller than the daily one and has 13 access gates instead of 22.

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- There are 2 different kinds of parking areas.
- EXCHANGE PARKINGS. Located outside the centre of the city, connection to the centre available by public transport.
 - PROXIMITY PARKINGS. These parking areas are near Rome's urban centre.

Rationale for the coach management project development

As mentioned, the tourism coaches permit management is very complicated and cannot be carried out only with fixed gates but needs a reliable VPS system.

An application of real Road Tolling could be carried out integrating in the coach scheme the Galileo VPS technique (GVPS), permitting the issue of temporary permit per trip, time, distance, once tested its reliability in LTZ complex urban situation.

The use of GPS-based positioning systems is presently not reliable because of the intrinsic positioning error, lack of certification and the not continuous availability of the system, discouraging widespread application.

Problems could arise especially along the cordon where correct position determination is fundamental: the enforcement procedure cannot accept position errors.

The proposal for a new EC Directive on road toll interoperability of April 2003 proposes to combine VPS/CN with DSRC in the short/medium term and to test its applicability before to HGV, buses and coaches from 2005.

On the other hand, the report adopted on December 18th 2003 by the European Parliament made several modifications to the Commission's proposal, including that satellite positioning technology should not be imposed as the only system from 2008 for newly introduced systems and from 2012 for all systems. Besides, rather than prescribing a mandatory switch to satellite and mobile communication technologies, the directive should focus on the goal of achieving interoperability across the board between the different electronic toll systems already in place.

The work together CAPITALS ITTS Project and basis for the full scale project

During Capitals ITTS project, a coach service trial was carried out in 2004. It can be considered as a business-to-business service (B2B), since it is a service to be used by coach drivers and coach companies. Specific software was uploaded in a PDA, with GPRS characteristics and a bluetooth GPS antenna configured. Coach service trial was then carried out with selected tour operators and coach agencies to show both common and coach specific service. The meeting, held in spring 2004, showed a real interest from the coach operators for ITS and web technologies as well as the simplify of the permit request, on-line booking procedures. The meeting showed also the interest of the Coach Operators to be informed on the traffic situation along their path and, in some cases, to be driven by a turn-by-turn navigator application. The integration of tourism and transport information is also of interest.

In the framework of the Capitals ITTS project, Traffic information were provided by STA and updated and delivered every 5 minutes to the mentioned PDA. The turn-by-turn service has been tested free of charge for three groups of six coach users, both for licence cost for software and GPRS communication costs to take the most of real time traffic information.



Figure 7: The PDA and the application software used for testing coach pathways

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From a technical point of view, trial experience showed the need to use a very reliable communication infrastructure, especially for what concern time-dependant information, like traffic status. The level of obtainable performances is still low in terms of tracking of specific fleets inside the Historical Center LTZ) from a GPS without EGNOS-aided system or Galileo with the aid of differential corrections: the masking of marks inside the city of Rome is strong and the lackness of certification of each position marker makes the reconstruction of the effective path impossible.

An off-line device, to be engineered starting from Capitals ITTS experience, is to be provided to the coach driver, integrating EGNOS/Galileo receiver, map of the city and turn-by-turn application software for the specific path only when Galileo system will be available. Integration of application software to inform the coach driver about the traffic situation on the path and of special events for tourists is expected.

The on-line analysis of the effective path followed by the coach isn't a fundamental requirement of the service: specific post-processing analysis has just to permit the downloading of the effective path and the calculation of the exact due fare once per day and where the use of the statistical data coming from repetitive use of the device will support improvement on planning mobility for coach.

c. Choice of BAT for 2-wheels control

A trend of increase of the number of two wheel access to the city centre has been noted in Rome, and similar trends have also been observed in other European cities that have introduced road pricing policies, e.g. London, Genoa and Barcelona.

These trends are strictly related to access restriction policies. No technology in fact exists to detect and recognise the plates of the two wheels.

Analysis in Rome

Different campaigns have been performed to evaluate the 2-wheels flows accessing the LTZ; results are depicted in the following picture, are showing that, during the restriction period (6.30am – 6pm), the number of 2-wheels accessing the Central LTZ zone is higher than the 4-wheels, with seasonal variations.

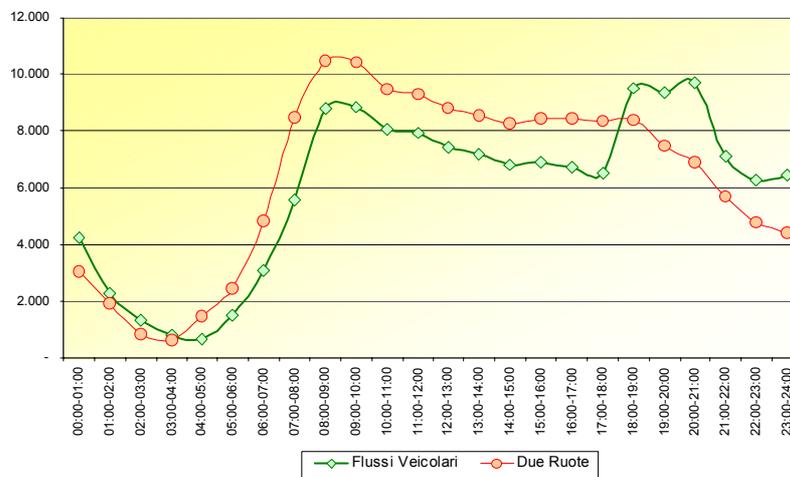


Figure 8: Access of 2(wheel) and 4-wheeled vehicles in the Central LTZ zone during a mean working day

In 2004, the composition of the 2-wheeled vehicle fleet in Rome is as follows:

2-wheeled fleet in Rome	Conventional	Catalysed	TOTAL
Motorcycles	123.250	151.112	274.362
Mopeds	118.890	64.018	182.908
Total	242.140	215.130	457.270

As a consequence, in Rome are thus circulating almost 250.000 not catalysed thermal engine 2-wheeled.

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Specific analyses on 2-wheels pollutants emissions have been carried out by the National Research Centre for Energy and Environment (ENEA) and reported in the section “The contribution of 2-wheels vehicles at urban areas air pollution” of the “Annual report on Rome’s air quality” where was showed that Particulate Matter (PM) emitted by 2-wheels private fleet represents an emerging environmental issue with PM emission rates comparable to a diesel car, with emission parameters comparable to conventional diesel car for conventional thermal 2-wheels vehicles and to catalysed diesel cars when dealing with catalysed scooters.

The need of complying with the new EU Directives on air quality makes important to dispose of an instrument able to automatically detect 2-wheels, because it will allow the implementation of restriction policies also to this category.

Technological issues

Existing automatic vehicles detectors are not able to detect 2-wheels because of:

- ❖ Uncertainty related to plate location within the section;
- ❖ Possibility of having more vehicles crossing the street section at the same time;
- ❖ Different type of plates for mopeds and motorcycles;
- ❖ Difficulty in detecting 2-wheels with the magnetic traffic counter loops due to their reduced mass.

The better technology tested during Miracles to overcome those constraints is based on additional OCR camera with a better resolution of the installed one in the existing ACS+RP scheme of the central LTZ, taking multi-pictures of vehicles crossing the gate and integrated by a specific software, able to detect vehicles and 2-wheels from the images. This system is characterised by low technological costs and a reliable post processing phase, whose costs are quickly decreasing.

STA/ATAC implemented in an existing electronic gate (Via di Corso Vittorio) this new technology of survey adapted to two wheels. The device installed on the passage is inside of an only container, with a protection degree IP65, having the typical dimensions of one television camera surveillance, sensor CCD, the infrared illuminator and the unit of elaboration of the images. STA carried out a measurement campaign whose objective has been the verification in field of the performances and possible uses of the new technology.



Figure 9: Details of the used device and its insertion in the track equipped for the control of the LTZ gate passage in Rome

The system allows to control the transit of motorcycles and to recognize their plate without others sensors. The analysis was reduced to two wheels over 50 cc., due to the small plate used by mopeds, that will be substituted by a national law in the coming years. It does not need any specific infrastructure and can be installed without having interferences with ACS+RP scheme in Central LTZ.

M6: Actual implementation:

a. Evening and night central scheme Analysis

In 2005, the Municipality, with Traffic Decision n° 1035 dated June 14th, 2005 decided to set-up the experimental summer period in the hours from the 23,00 to 03,00 from Friday to Saturday, adopting the ACS+RP diurnal scheme in a narrow area. Hence, the central nocturnal ZTL, started on 17 June until 10 August; after one interval, it was continued from 20 August to 17 September.

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After the positive results of the trial, this new LTZ is from **October 6th, 2005** a structural measure in all the weekend nights in Rome. The traffic decision n° 1099 dated October 7th, 2005 officially institutes the night Central LTZ.

b. RP schemes for Tourist Coach

The new Municipal plan for Coach in Rome was finalised during the first six-monthly period of 2005. The new Coach Plan, after a period of joint verification with the main associations of category, was approved October 27th, 2005. The Tourist Bus Plan will enter into force January 1st, 2006. It is an updating of the previous coach plan, where its main peculiarities are confirmed, with the introduction of new limited time parking areas, new structure of the tariffs, with reduction of the typologies and introduction of a fare also for coach less than 7 meter, new weekly, monthly and yearly passes, new management of special events. Main new topics are:

- ❖ Daily fare reductions of 20% of the type "D" permission for the buses of length over seven meters (until June 2006) and of 15% for buses less than seven meters, only for the permissions related to the stop areas and to the buses with remittance outside from the territory of the Rome Municipality;
- ❖ Five new areas of hop-on and off for the tourists, with stops of 15 minutes maximum, and seven new areas of short pause that, together, will permit a two hours stop to tourist buses without to stop in the external exchange parkings;
- ❖ Antipollution benefits, i.e. reductions in price of 30% for coach engines meeting Euro 3-4 requirements and fare increases for the more polluting vehicles Euro 1 (after 2007 they will not be permitted to access the city) and Euro 0 (now admitted in external LTZ for coach 2 until June 2008);
- ❖ Institution of auxiliary mobility personnel in STA, for the immediate control of the circulation and the stops of the coaches;

Besides, the core of the monitoring and assistance concept is introduced, permitting the application of technologies and devices to have information on the effective path followed during the day by each coach, in order to verify the match with the sold permit and to detect violations. The devices should be Galileo based in order to have the certification of each position of the vehicles, but at the moment Galileo system is far from continuous service delivery as well as the proposed directive on the European telepaying system is far from becoming an Italian law. As a consequence, the choice of the system isn't taken, even if the coach congestion problem is increasing. A solution GPS based, with possibility to upgrade towards Galileo is under development. Its implementation is anyway expected late 2006. In any case, the Coach Plan includes the institution of a technical table with the task to study the adoption of control systems and automatic coach monitoring, to be adopted in 2006, and to verify eventual new stop areas.

c. Choice of BAT for 2-wheels control

Test on specific devices showed that a specific sensor can be installed on the same pole of the LTZ existing gates without interfere with this system and that the percentage of recognised plated is comparable to the other vehicle system one and this new system doesn't need any dedicated lane.

The testing activity was the part included in Miracles project as well as the analysis of the new electronic gate homologation and the software integration, while the installation of 5 such systems in the most important gates of the central LTZ is included in the PICOR Project co-financed by the Italian Environmental Ministry and approved by the City Council. This large scale activity is expected in the second six-monthly period of 2006

The automatic detection of 2-wheels at the Electronic gates of the ACS+RP system will support the **implementation of the new restriction in Laboratory Area to not-catalysed mopeds and motorcycles in order to reduce pollution, particularly PM10 and C6H6, to be effective since 1.01.2007.**

M7: Deviations from the plan:

As already explained, the original plan in this WP6.1 in Rome was expecting the progressive introduction of a pure RP (Road Pricing) scheme in the Central LTZ in the evening hours, The deep analysis carried out during the MIRACLES project was demonstrating that a different measure is more suitable. As a consequence, the plan was modified and the "Night Central LTZ ACS+RP scheme" is now a reality.

In other parts of the measure (i.e. BAT for 2-wheels control and RP schemes for coaches), no substantial deviations.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

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For measure 6.1 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*, *Cost for operating*, *Cost for maintenance*, *Total income for pricing*: removed because, excluding night central LTZ, the other measures were only trials, to be implemented in the future in a structural way. The cost for operating night central LTZ are included in the maintenance costs for daytime ACS+RP scheme.

Evaluation category: *Transport*

- *Average delays/waiting time*: removed because not relevant to the amended measures

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Given the high number of indicators several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.

Environment indicators

Information on environment comes from air quality assessments concerning the emissions of CO, particulate and benzene. For the ex ante and ex-post evaluation, data from ATAC traffic control center were used. Here, due to the outcomes from measure 11.2.2 (see related template) a complete traffic-environment chain was integrated, giving the traffic flow on the whole primary network of the Laboratory Area. The traffic information are converted into emission parameter through the integrated TEE model, supplied by ENEA. It calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry.

For what concerned pollutant concentrations, still indicators about CO, particulate and benzene were studied, mainly coming from Air Quality monitoring stations network in the city of Rome.

For what concerns concentrations, still indicators about CO, particulate and benzene were studied; moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration were carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution is available. In particular, air quality data were acquired by the monitoring stations of the laboratory area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives. Benzene was measured by a passive samplers method: the Radiello® diffusive samplers; these are samplers in which the diffusive and absorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially and parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface.

Since the enforcement on the law about the noise pollution is very recent, the gathering of quantitative data on noise was possible only on few spots. Spot measurements were run on a 30 minutes basis, and repeated several times during the weeks. Measurement devices were Class 1 phonometers, located 1,5 m above the ground level and 1 meter far from reflecting surfaces.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Transport Indicators

For the baseline, and in general for the ex ante analysis, a big part of information concerning mainly the quantitative indicators was developed before, after and during the 2000 Jubilee. For this event esteems, models, surveys, measurements on the most relevant spots were run in order to quantify and to check impacts as the changes of traffic, of parking and of the Public Transport service. Such surveys were repeated after the 2000 Jubilee event thanks to other occasions, as other special events or other EC projects involving Rome. Besides, the set-up of the so-called “Mobility Observatory” in ATAC by the Mobility Department permitted a continuous updating of all the mobility data, thanks also to data coming from the ATAC Traffic Control Centre. Here, due to the outcomes from measure 11.2.2 (see related template) a complete traffic-environment chain was integrated,

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giving the traffic flow on the whole primary network of the Laboratory Area.

Moreover, information coming from the Environmental Department of the Rome Municipality, especially from the yearly report on the air quality status in the city, were used. For what concerns Public Transport, the ATAC "infopoint" (a GIS based database) continuously provided information on the service. Hence, to describe the ex ante phase, most of quantitative information were obtained by existing database, which were continuously updated to collect data available for the ex post phase.

For what concerns the RP scenarios, indicators were defined applying a model methodology. To model correctly user behaviour before and after the introduction of the measure, existing data coming from other projects were used to simulate the impacts of the assessed measures. To simulate access restrictions results two O/D matrices representing authorised and not authorised car users trips and access rules to LTZ were considered. The model was based on user equilibrium multi-class (i.e. the two classes authorised and not authorised car users) assignment procedures, where travel time of each link in the network was calculated iteratively with specific link performance functions. The private transport graphs and the O/D matrices were supplied by STA and elaborated by DITS. For the supply model the whole Rome urban area was taken into account. The network was based on a graph of 4861 links and 3367 nodes.

Besides, for the Thermal 2-wheels control in Central LTZ, two wheels surveys were based on the implementation of a special device installed on the survey spot, within a box, with a protection degree IP65, with the typical dimensions of one television camera surveillance, sensor CCD, the infrared illuminator and the unit of elaboration of the images. Surveys were run during three periods: 11th August, 2004, 8th September, 2004; 6th October, 2004.

M9: Achievement of quantifiable targets:

During the project discussion was said it is quite difficult to quantify results, in the sense that consideration needs to be given to the political risk involved in road pricing, the political willingness, the citizens' participation and awareness of schemes impacts. Now, completed the feasibility studies, specific quantified results are available and they are showed in M11. The headline indicator can be considered:

- ❖ Reduce the number of vehicles in weekend nights by 25%.
- ❖ Reduce the number of vehicles by 10% during 24 hours period every day of the year in the LTZ, especially in weekend nights.

M10: Achievement of evaluation-related milestones:

The evaluation process was affected by some minor delays in the provision of information because of the complexity of the implementation process listed below; however this did not affected the edition of Deliverable 4.2.

M1: Execution of pilot pricing experiment and release of trial results (month 26): changed with execution of trial on Night Central LTZ ACS+RP Scheme, obtained in month 40

M2: Release of Municipality new regulatory act for LTZ road pricing: (month 32): changed with new regulatory act for Night Central LTZ ACS+RP Scheme, obtained in month 44

M3: Study to extend road pricing in time and space (month 32): Study completed in month 38. It took to the decision of setting-up the night central LTZ.

M4: Feasibility study to apply RP policies to 2-wheels and tourism coach. Completed with new Act on RP for coaches in month 44.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) General outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) The measure specific results
- c) A comparison between quantifiable objectives and actual achieved results

a) General Outcomes

All results for ex-ante and ex-post situations, according to the evaluation categories and selected indicators are reported in Table 3 and hereinafter shortly commented. In particular, in Table 3, the "ex post value" column provides actual indicators results which will be compared to the measure objectives.

The general objectives, as listed in the Deliverable 4.1 were:

1. To Introduce flexible road pricing measures, according to different situations and periods of the day/month/year.
2. To reduce the traffic flows converging to the centre of the city (LTZ),
3. To increase the usage of Public Transport;

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4. To reduce traffic related air-pollution.

Objective 1 has been achieved thanks to the trials, first, and the implementation since October 2006, then, of the night central scheme.

Such implementation contributed mainly along with the WP5 measures to reduce traffic related air-pollution (it must be reminded that the comparison, in terms of concentrations, between the annual mean values, recorded in 2001 - Baseline - and the mean values in 2004 -ex post evaluation - showed a reduction of CO concentration of about 21%, PM10 of 11% and Benzene of 37%). Moreover, noise reduction is appreciable being decreased by 4 dB(A) in the daytime, but night levels are still above the law limits.

Transit supply improved noticeably, in terms of increased number of routes and new lines, as well with the reduced journey time. What is worth to stress however, is the hugely increased number of passengers which is in accordance to the usual forecasts on shifts from private cars to transit when road charges are enforced.

For Objective 2, it is worth noticing the already recorded 20% reduction during the ACS restriction period (see 5.1.b template section M11) goes in hand with the observed reduction during the night scheme trial, described at b.1

b) Measure 6.1 specific results

Specific results for the WP6.1 measure are reported and commented as follows.

b1. Central LTZ - Night scheme on weekends

The first results are reported in Figure 11, that points out a crucial change in the period of restricted access if compared to the previous situation. During the first weekend of the scheme (June 2005), a reduction of 60% (from 10,000 to 4,000) in the number of four-wheeled vehicles was recorded. It was considered that there was some indication that subsequent results will confirm this. To such reduction corresponded an increase of the two wheels (Figure 12), being no police enforcement and probably induced by summer period. The first results trend however shows that during the hours of operation, vehicle flows were typically reduced by 20%, while the number of two-wheeled vehicles increased by 20% and public transport use increased by 6%.

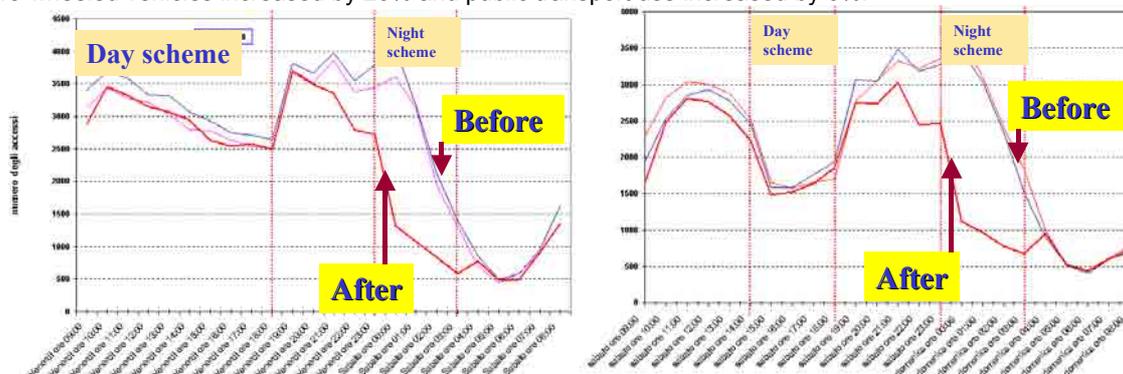


Figure 11: Results of the Central Night LTZ scheme (23.03) for 4-wheels vehicles, 17-18 June 2005

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2-wheels vehicle accessing Corso Vittorio gate

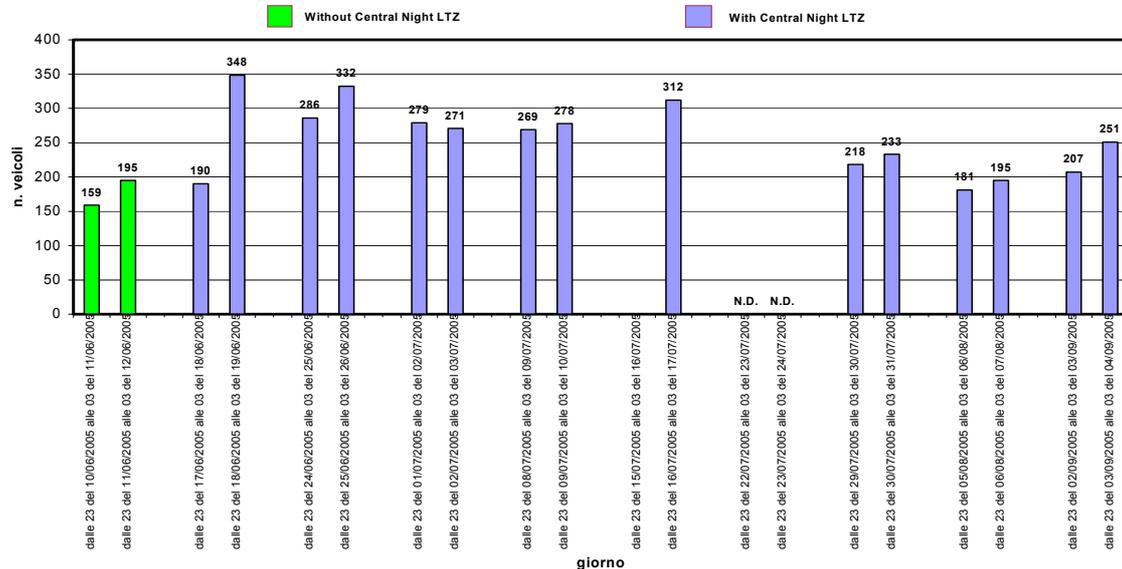


Figure 12: Results of the Central Night LTZ scheme (23-03) for 2-wheels vehicles in the testing period b2. Thermal 2-wheels control in Central LTZ

STA implemented in an operating electronic gate passage (Via di Corso Vittorio) this new technology of survey adapted to two wheels (for the device characteristics see end of section M8). STA carried out a measurement campaign whose objective has been the verification in field of the performances and possible uses of the new technology. A detailed campaign was carried out in three Wednesdays:

- ❖ Off-peak demand: 11th August, 2004
- ❖ Medium demand: 8th September, 2004
- ❖ Peak demand: 6th October, 2004 (schools time)

Then, the survey period were: 7:30/10:30 morning rush hour, 17:00/20:00 evening rush hour, 21:00/24:00 night rush hour.

The survey concerned 2-wheels vehicles with regular plates, i.e. the ones with engine > 50 cc, because the Italian law on mopeds plate is still under a revision process which will lead both mopeds and motorcycles to have a regular plate.

The achieved results put in evidence that the motorcycle flow is higher in the rush hour of the morning (7:30-10:30). The opening of the schools does not influence the access of the two wheels in the ZTL, due to the presence of school-time-related permission for cars; the evening period (17:00-20:00) is characterised by an increased percentage of private cars accesses regarding the motorcycles; (accesses peak after 18:00 when the restriction is off).

in the night period (20:00-24:00) cars still are the main accessing vehicles, even though the amount of the 2-wheels accesses is high).

Intera giornata (00:00 / 24:00)								
Giorno	Motoveicoli		Autoveicoli		Non leggibili		Totale	
11 agosto 2004	1813	24,14%	5412	72,05%	286	3,81%	7511	100%
8 settembre 2004	3326	30,02%	7502	67,72%	250	2,26%	11078	100%
6 ottobre 2004	3465	30,93%	7517	67,09%	222	1,98%	11204	100%

Table 2: Global results of the 2-wheels measurement campaign in the Central LTZ.

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In conclusion the access to the ZTL of the motorcycles is about of 30% of the demand: as a consequence, it is necessary its management, monitoring and regulation. The new technologies can be an effective tool towards this direction.

Measure 6.1: Time based entrance/ road pricing policies								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.1/Env.1.a		polluting vehicles (no of polluting vehicles)	1) 868.720 2) 441.110 3) 64.796	a)465829 b)366923 c)121991 d)101564 e)2536	a)399728 b)356860 c)163015 d)158338 e)2536	a)397834 b)353689 c)163804 d)156311 e)2573	1) 550.319 2) 242.140 3) 42.435	The figure are referring to whole city and to: 1)Not cat cars; 2)Not cat 2-wheels; 3)Not cat comm. a)Gazoline car <1,4t b)Gazoline car >1,4t c)Diesel car <1,4 t d)Diesel car >1,4 t e)Buses
R6.1/Env.2.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R6.1/Env.2.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city

Table 3 - ex-ante and ex-post results in Rome: WP 6.1

Measure 6.1: Time based entrance/ road pricing policies								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.1/Env.2.c		emissions of C6H6 (kg/h and kg/day)	1) 96 2) 697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R6.1/Env.3.a	5	concentrations of CO (millig/m ³)	1.77			No direct data available See table 2	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stat) (***)
R6.1/Env.3.b	6	concentrations of particulates (microg/m ³)	50.0				44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***)
R6.1/Env.3.c		concentrations of C6H6 (microg/m ³)	1) 8.75 2) 6.6				1)5.55 2)4.8	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***) 2) Measured value by passive samplers method (**)
R6.1/Env.4.a	12	day/night level (dB(A))	day = 67 night = 55	day = 65 night = 55	day = 65 night = 55	day = 65 night = 55	day = 62 night = 60	The Base year value is referred to a LTZ (San Lorenzo) near the MIRACLES Laboratory area; the spot is (Via dei Sardi and the other parts of the area of are below the zone limit (65 dB(A)) For trend frozen and Baseline scenarios no variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS

Notes:

(**) Mean normalised value of all the 57 monitored locations. See specific document in Air Quality Report.

(***) The values of Villa Ada stations are not considered due to its use for the characterisation of the background air quality status of the city.

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Measure 6.1: Time based entrance/ road pricing policies								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.1/Soc.1.a	14	acceptance	No quantitative data available				Population 3.57 3.80 cluster1 3.65 cluster2 3.16 cluster3 3.63 cluster4 3.41 cluster5	(Likert 1-5) Acceptance = how the satisfaction score takes part of the different clusters of the local culture
R6.1/Soc.2.a	13	Awareness	No quantitative data available				46%	
R6.1/Soc.2.b	19	Use motivation	No quantitative data available				61 cluster1 41 cluster2 42 cluster3 33 cluster4 57 cluster5	
R6.1/Soc.3.a		Expectations towards involved agencies/bodies	No quantitative data available				Administration invests in satisfaction for the citizen: -75,6; +24,39; Administration invests in services: -40,99; +59,01; Administration invests in production activities: -7,66; +92,34; Administration invests cultural heritage -13,55; +86,45	
R6.1/Soc.3.b		Satisfaction level	No quantitative data available				3.57	

Table 3 (cont.) - ex-ante and ex-post results in Rome: WP 6.1

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Measure title: Integrated Pricing Strategies

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Measure 6.1: Time based entrance/ road pricing policies								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.1/Tran.1.a	21/22	modal split (motorized and non motorized) (% of the total flow)	1) 20 a) 20 b) 48 c) 11 d) 21 2) 30 a) 30 b) 27 c) 23 d) 20	1) 22 a) 22 b)+c)53 d) 25	1) 22 a) 22 b)+c)53 d) 25	1) 22 a) 22 b)+c)53 d) 25	1) 18 a) 18 b) 47 c) 8 d) 27 2) 31 a) 31 b) 22 c) 24 d) 23	1)whole city 2)Rail Ring Area a)PT b)Priy 4-wheels c)Priy 2-wheels d)Walking
R6.1/Tran.1.b	21/22	traffic levels (trips day per vehicle)	2,2	2,5	2,5	2,5	2,5	
R6.1/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42	1)4,8 2)1,53	1)4,8 2)1,53	1)4,9 2)1,55	1)6,1 2)1,5	1)whole city 2)Rail Ring Area
R6.1/Tran.2.a		pay for parking lots (increase/decrease) (no.)	52000			65006*	66.500	* supposed improvement of 5% /year from 2001 No variations foreseen for frozen scenario
R6.1/Tran.3.a		trips per line (no./day)	206				216 express 109 electric	No variations foreseen for frozen and trend scenarios
R6.1/Tran.3.b		Routes (no.) (clean vehicles only)	1				5+1	No variations foreseen for frozen and trend scenarios
R6.1/Tran.3.c	18	Journey time (min) (clean vehicles only)	17				50	No variations foreseen for frozen and trend scenarios increase in lines quantity and lines length
R6.1/Tran.3.d		travelled people (no./day) (clean vehicles only)	370				10000/12000 pax/day electric buses 32000 pax/day trolleybus	No variations foreseen for frozen and trend scenarios

Table 3 (cont.) - ex-ante and ex-post results in Rome: WP 6.1

MEASURE-LEVEL RESULTS

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Project: MIRACLES

Measure number: 6.1 Time based Road Pricing

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c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Reduce the number of vehicles in weekend nights by 25%.	With the new Central Night LTZ scheme, a mean reduction of 50% (from about 10,000 to 5,000) in the number of four-wheeled vehicles was recorded during summer 2005, along with an increase of two wheels, even not comparable (from a mean of 200/day to 350/day).	<i>This scheme for weekend nights wasn't expected at the beginning of the project, but the increase of pressure towards pubs, cinemas, discos and restaurant in the city centre made it necessary.</i>	☺☺☺
2) Reduce the number of vehicles by 10% during 24 hours period every day of the year in the LTZ	Traffic flow in the Central LTZ decreased during the 24 hour period from 138.000 end 2001 (after the opening of electronic gate system) to 118.000 mid 2004, i.e. with a further decrease of 17%	<i>The continuous and sustainable decrease of the traffic flows, mainly outside the restriction period, postponed the application of a pure RP scheme in such time period.</i>	☺☺☺

Caption
 ☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level
 ☹ difficult to assess ☹ not achieved

Status of the Measure beyond MIRACLES

The measure (including all the subtasks) is going to be completed with some modifications/improvements and it will continue beyond MIRACLES

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The application of Road Pricing schemes is still controversial and considerations are involving the political risk associated with such a matter and the citizens' participation, awareness and reaction to these schemes.

Anyway, Rome Municipality emitted during Miracles project two official Council Acts (the latter is Council Decision 1168/05 dated January 18, 2005), where the considerations regarding the emerging issues due to the application of RP schemes, especially in the city centre were completely taken into account and STA was encouraged to study these problems and to propose the best achievable solutions. According to this, a proposal to recover funds from the Environmental Ministry, supporting the implementation of RP schemes with another specific plan, was prepared at the beginning of MIRACLES by STA.

This preliminary project, called PICOR (meaning "Integrated Pricing in the City of Rome") - including projects for all the three main items, i.e. evening/night scheme, 2-wheels detection and RP electronic scheme for tourism coach - was sent to the Italian Environment Ministry, partially cofinancing the plan, in February 2003. Municipality received comments from the Ministry and finalised the preliminary project in January 2004. After another comments and answers period, the Ministry approved the Project with an its specific Decree, n° n° 331/DSA/2004, dated October 2004.

This project was used by the Municipality to support its considerations on RP schemes and it is also part of its strategy in this field.

M13: Interrelationships with other measures

5.1 Access Restriction, 5.2 Introduction of pedestrian areas

6.2 Flexible parking policies

Awareness raising aspects of WP10 – WP3 and in particular the impact of highly polluting vehicles.

M14: Lessons learned

The complexity of the activities for the launch and the follow-up of a urban RP schemes in a city like Rome ask for a notable effort of communication, probably underestimated in the first phase. The whole Municipality plan regarding mobility policies is to be presented to the citizens when such important measures are adopted,

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explaining clearly their motivations: it could allow simpler acceptability of the measures themselves, generally seen as a limitation to the personal mobility. Complete information on the benefits can support the request of some sacrifices in terms of mobility to the citizens. Of fundamental importance is then to make available to the citizens information on alternatives to the private car, reinforcement of the public transport as well as the typical actions of Sustainable Mobility (car-pooling, mobility management incentives).

In general, the lack of a general policy about road pricing must be registered at national level and no directive is available defining, in general way, a "fair price" in relation with each end-users category; the only act about access limitations is section 7 of the Road Rule Code which gives municipalities power to regulate private vehicles circulation "for checked and motivated preservation and preventive measures", defined only in very general terms.

The forthcoming EU Directive also risks creating further problems with the hypothesis of a phase out in few years of the DSRC systems in favour of the VPS system, presently not yet reliable for large scale applications.

The implemented ACS+RP scheme and the Night Central LTZ scheme as well as the introduction of RP policies for 2-wheels and special fleets have the general objective of reducing the pressure of private motorisation towards the city centre, in order to achieve the always more restrictive air quality limits according to 99/30 UE directive, especially towards PM10 limits. A specific Regional Decree (n° 1316 of 5/12/03) gives full responsibilities to the Major of the "Risk Area of Rome" in order to take measures when these limits are not respected. In the MIRACLES years and notwithstanding the efforts carried out, Rome is still having pollution exceedances.

As a consequence, the control of specific "polluting" categories (ex: freight delivery, coaches) in their complete pathway as well as the integration of devices able to control 2-wheels passages is a must for the city of Rome. While new devices could solve the problem of 2-wheels, the use of Vehicle Positioning System in large scale could help to monitor the above said special categories, but the present limitation of the VPS system makes impossible at the moment this achievement and Galileo applications are expected not before some years.

VPS systems in act offer much more flexibility in defining or refining the charging system because they use "virtual gantries". As an example, the tourism coaches permit system is managed by STA and their control is very complicated and cannot be carried out only with fixed gates but needs a reliable VPS system. The requirements for such VPS system are in fact very strong, both in terms of signal reliability/certification and in terms of system management. The use of GPS-based positioning systems is presently not reliable because of the intrinsic positioning error, lack of certification and the not continuous availability of the system, discouraging widespread application. Problems could arise especially along the cordon where correct position determination is fundamental: the enforcement procedure cannot accept position errors. Such application of real Road Tolling sees in the future the possibility of integrating the Galileo VPS technique (GVPS), permitting the issue of temporary permit per trip, time, distance, once tested its reliability in LTZ complex urban situation.

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7. Measure 6.2 - Environmental Parking Charges

MEASURE-LEVEL RESULTS	
Measure title: Integrated Pricing Strategies	Project: MIRACLES
Measure number: 6.2 Environmental Parking Charges	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>In the City of Rome parking is an integral component of the urban mobility system. The basic tariff strategy states that the system must provide an adequate price range in terms of parking costs in proportion to the distance from the high demand areas.</p> <p>There must be a balance between the parking supply, the public transport services, urban planning and demand management strategies. Therefore, on-street parking services are considered a vital contribution to the fine tuning process of the overall parking system so as to respond as well as possible to the dynamics of the changing demand. As to the strategic aspects, basically the intention is to eliminate unnecessary parking and to reduce vehicle-kilometres.</p> <p>Consequently, the measure objectives are:</p> <ul style="list-style-type: none"> ❖ to increase the number of on-street parking places inside the Laboratory Area (2nd District). ❖ To perform a feasibility study to evaluate flexible parking charge measures, according to different situations and periods of the day/month/year. <p>In fact there must be a balance between the parking supply, the public transport services, urban planning and demand management strategies.</p>	
M2: Measure description:	
<p>A key element of the current traffic policy of the city of Rome concerns the large scale implementation of on-street pay parking in the whole central area, mostly dedicated to business activities, as well as social, political and commercial activities.</p> <p>Such a policy began in 1994, since that date paid parking has become increasingly important, i.e. discouraging people to use cars for "systematic" journeys to the city centre. STA/ created paid parking spaces on roads in its inner zones and directly manages the on-street parking system in Rome, integrated with general strategy of the Municipality to favour the parking outside the Rail Ring Area with the creation of off-street low cost parking area connected to the main exchange points of the Public Transport and the always increasing taxation of on-street parking inside the Rail-Ring, including inside the two inner zones of Rome.</p> <p>Within measure 6.2 "Environmental Parking Charges" the following two activities were carried out in Miracles:</p> <ol style="list-style-type: none"> 1. <i>The extension of the on-street parking places</i> up to at least 65,000 in the whole Rail Ring, covering also the II District, now excluded by the measure, and 2. A feasibility study for future implementation of a new parking policy based on introduction of different parking fares. 	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The completion of the on-street parking zone inside the II district, presently not charged, will permit to have the whole rail-ring area subject to charge for on-street parking, making a fundamental step towards the practical implementation of the of the General Urban Traffic Plan, as adopted by the City Council. Besides, a verification of the possible future introduction of the flexible parking charge concept integrated with environmental costs estimations in terms of fuel consumption and towards modal shift, need to be carried out in order to permit the best use of the available space.</p> <p>Innovative payment parking technologies have been tested within the MIRACLES projects; these are based on new parking meters and on the mobile phone usage to pay parking tariffs. The former will allow to use the mostly known payment systems like Credit Cards, debt cards, etc and are powered by solar cells. The latter to allow and to facilitate payment methodology removing the waste of time for buying tickets; simplifying payment procedures and eliminating the need of setting beforehand parking time.</p> <p>Finally, a feasibility study has been performed to evaluate the application of flexible parking fares based on the area characteristics; different fares for commercial, residential areas and public transport hubs (e.g Park&Ride).</p>	
M4: Situation before CIVITAS:	
<p>In 2002, STA took directly the management of the on-street parking system in Rome, integrated with general strategy of the Municipality to favour the parking outside the Rail Ring Area with the creation of off-street low cost parking area connected to the main exchange points of the Public Transport and the always increasing</p>	

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taxation of on-street parking inside the Rail-Ring.

STA (now merged into ATAC), in order to verify the respect of the payments, supports the Urban Police with 220 "Traffic Wardens" who have the possibility of issuing fines for missing parking payments.

On-street parking pricing was based on fixed hourly rates of 1 € for approx. 52.000 parking spaces distributed in the territory of the Municipality of Rome inside the Rail Ring. i.e. the Laboratory Area of the Project. Payment is predominantly made by ticketing systems. Parking meters are located in the on-street parking areas; the driver inserts coins or pre-paid magnetic cards in the parking meter to obtain a ticket which authorises the driver to park the vehicle for a given period of time, based on the current tariff, presently fixed to 1€/hour. A different 1 hour duration pre-paid card (where the user is requested to mark the date, hour of valid parking time) can also be used to pay along with a pre-paid or individual autopark unit.

While the fare was fixed, the schedule for payment request in each zone was different. The on-street payment is not due on holidays and it is free-of-charge for the residents in each zone and other specific categories, according to the Italian Road Code. With the direct consequence that only the 20 % of parking places is available for paying users. First aim is to increase the total number subject to charging in the whole Laboratory area, especially in the II district, presently excluded by the charging.

The following map shows a detail of the central area of Rome, where the situation before MIRACLES of the on-street pay parking is highlighted with two on-street parking companies operating the management and fare operation of the system with a lot of passages through Municipal offices.

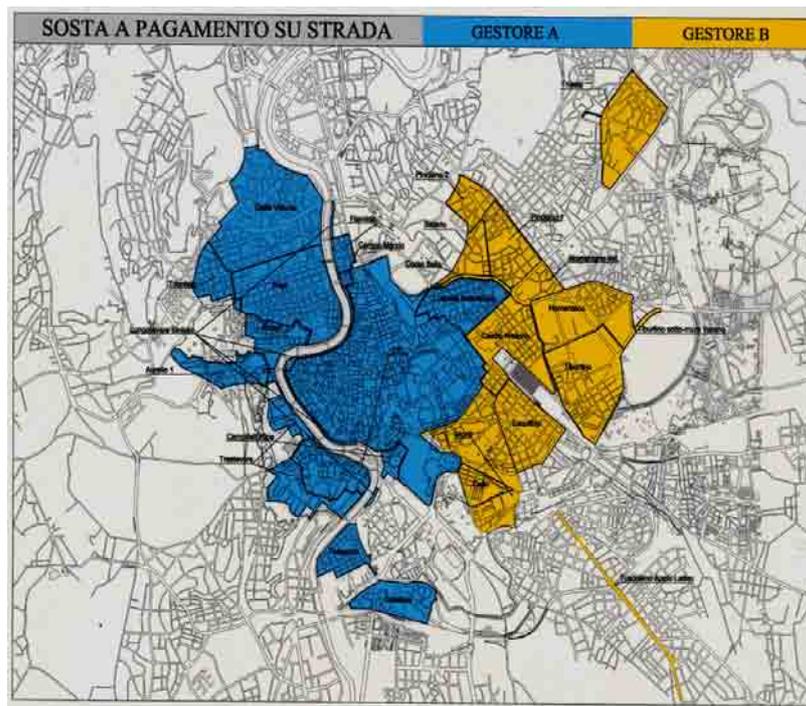


Figure 1: Situation of on-street parking places before Miracles

M5: Design of the measure:

a. The extension of on-street payment parking places

The Municipality of Rome with the support of STA/ATAC need to complete the taxation of the whole LA for what concerns on-street parking, according to the General Urban Traffic Plan, approved in 1999. As a consequence, during MIRACLES the on-street parking places subject to payment inside Rail Ring have been increasing, up to approximately 78.000; according to the picture below (figure 2).

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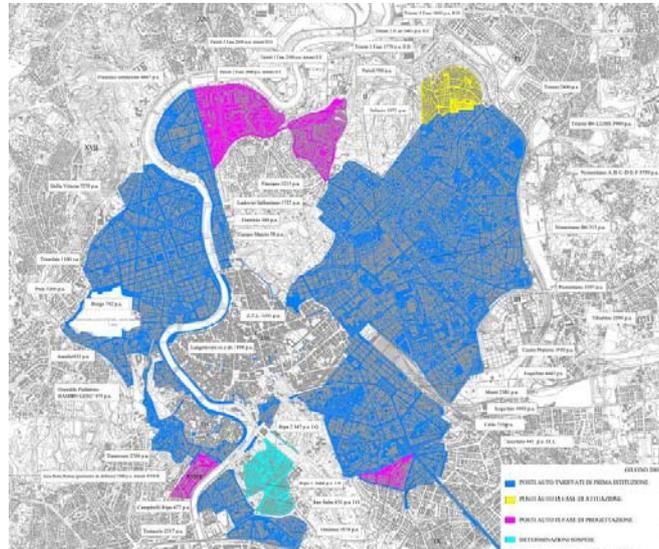


Fig. 2: Situation of the on-street payment parking places in MIRACLES laboratory area

Blue areas represent already existing payment parking places, yellow and red areas represent areas where payment parking was activated by the end of year 2005, while pink areas indicate places where payment parking is under implementation in 2006.

In 2005 some 11.000 pp were implemented, including areas in the southern part of the MLA (San Saba and Ripa districts), in the eastern zone (Appia and Gallia areas) and in the northern zone (II Districts), where the completion of the payment zone, up to reach about 85.000 parking places, is expected within 2007.

All pink areas (parking payment not existing) are located in II District that is the last *missing part* in Rome's Municipality payment parking strategy. In the II District, problems connected with traffic-flow patterns, connections with the adjoining I District and parking areas were tackled by implementing the above plans in a number of different ways, including LUTP showed in template 5.2.b, in order to reach a smooth transition from central to semi-central areas. Trieste neighbourhood is representative of such process, where demand is high for short-term parking due to the number of traffic attractors, such as businesses and trading concerns, and the high density population: the perimeter of the Trieste neighbourhood within which Rome City Council decided to introduce parking payment coincides with an area of high-density housing and where need for parking is higher.

In general, the planning phase for the institution of new payment parking zones covers all the preliminaries leading up to the Traffic Executive Decision, which can be summarised under the following principal activities:

1. Survey;
2. Design;
3. Project evaluation by the competent institutions (depending on the subject matter and territorial application);
4. Final drafting of the Traffic Executive Decision.

In the following some details of each phase are given.

1. SURVEY

Surveys are carried out in the streets where parking payment is to be introduced using vectored maps to evaluate the physical aspects of roads and parking areas as well as all the current traffic regimes.

A survey is also carried out of the types of building since this provides useful information about the activities in the area and the nature and quantity of the parking demand and traffic to be found in the streets inspected. The graphic representation of the results becomes the basis for further planning.

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2. DESIGN

All the elements surveyed are used in defining the design, which shows the streets network and all the traffic regimes as represented by vertical and horizontal street signs. These designs are prepared for printing on A4 size paper on a scale of 1/500 at the specific request of the Council. As a general rule, spontaneous parking and local traffic phenomena tend to be considered part of the identified demand during the design phase, in order to have a more linear and less invasive demand representation. Nevertheless any modifications to improve the whole system are also taken into consideration during this phase.

3. EVALUATION OF THE DESIGN BY THE COMPETENT INSTITUTIONS BY SUBJECT AND TERRITORIAL APPLICATION

When the design is completed its content is assessed by the City Council to evaluate the various choices and any further suggestions that have surfaced during the drafting of the design.

4. DRAFTING THE TRAFFIC EXECUTIVE DECISION

When all the suggestions have been received, the Traffic Executive Decision, comprising the text of the decision accompanied by the above-mentioned design, is drafted.

The document is divided into three sections: a preamble where all the acts leading up to the introduction of parking payment are cited; the body of the document containing a street-by-street description of the traffic regimes; and a final part describing the different parking facilities, including information about how parking charges are implemented, i.e., cost, times, exemptions, etc

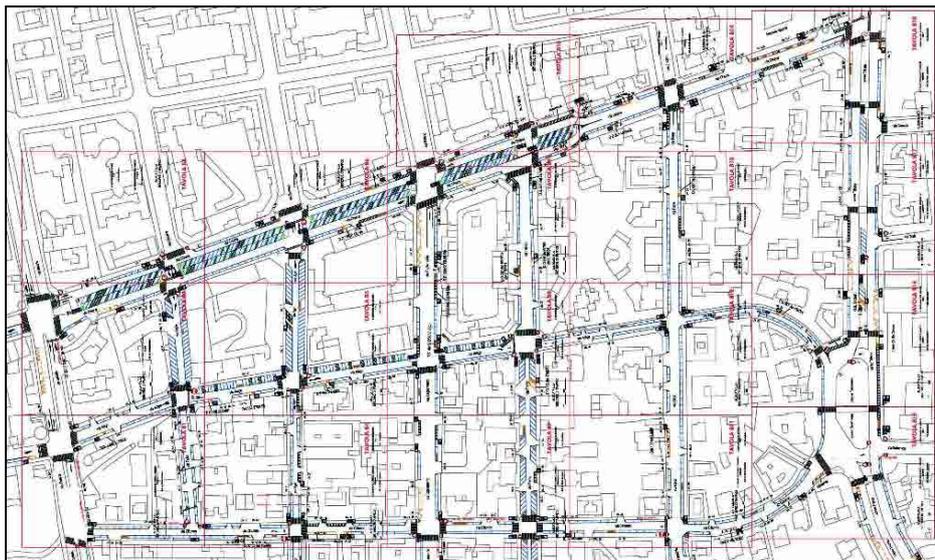


Figure 3: Example of II district design payment parking - zone Trieste

In order to support the need of controlling the increased number of pp subject to payment, STA/ATAC during Miracles reached the figure of 340 Auxiliary Traffic Wardens appointed by the Mayor (according to the "Bassanini Law") control and verify any irregularities in paid parking areas from the number of 200 at the beginning of the project.

Design of new payment methods

As already mentioned, parking payment was predominantly made by ticketing systems. Parking meters are located in the on-street parking areas; the driver inserts coins or pre-paid magnetic cards in the parking meter to obtain a ticket which authorises the driver to park the vehicle for a given period of time, based on the current tariff, presently fixed to 1€/hour.

A different 1 hour duration pre-paid card (where the user is requested to mark the date, hour of valid parking time) can also be used to pay along with a pre-paid or individual "autopark" unit.

Both of them have some limits to service convenience and availability:

- Searching for park meters
- Cash availability
- Searching a shop selling payment tickets
- Obligation to fix a time for parking for not running into penalties
- Coming back to the car for leaving ticket inside

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Therefore, an **innovation plan** for parking meters is currently under implementation in order to allow the payment by Credit Cards, debt cards, ecc. Besides, the new parking meters are powered by solar cells, reducing the implementation and power supply costs. The current situation is reported in the following picture, where the new 400 STELIO achieved during MIRACLES are included.



Figure 4: Way of ticketing for on-street parking with numbers of parking meters.

Besides, it is necessary to introduce a user friendly system facilitating more the payment for users. In details, this system has to allow to:

- ❖ Remove time limits for buying tickets
- ❖ Simplify payment procedures
- ❖ Have no limits for settling beforehand parking time

The identified solution relies on **mobile phone** use that, thanks to ICT new technologies, is able to support both rate collection and control by authorised staff. Users advantage are the improvements in service accessibility, the payment system without fixed duration of the parking, the direct communication channel with STA/ATAC.

For STA/ATAC (Municipality) there is integration with new controls and error reduction, user's fidelisation, cash and pre-paid vouchers decrease, real-time data on the use of the parking system, permitting analysis and better activity schedule. Besides, the integration and automation of the fining related activities is possible

In details, the setting of a parking payment service through mobile phone consists of three main operative steps:

- ❖ Users registration
- ❖ Service payment (time rate)
- ❖ Supervision by STA manager

In the following figure the description of system architecture from the user and STA side respectively is depicted.

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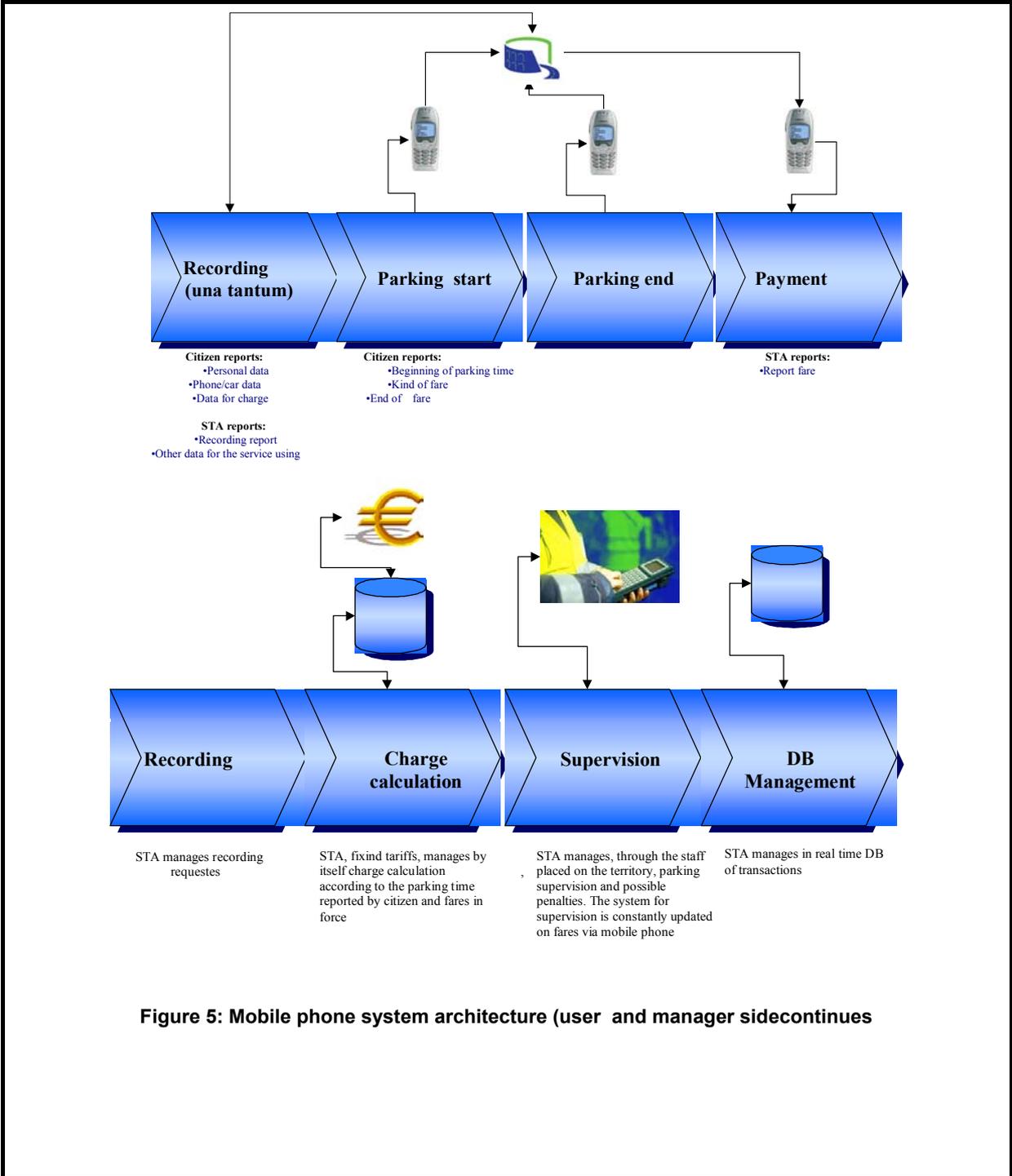


Figure 5: Mobile phone system architecture (user and manager side) continues

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b. Feasibility Study for flexible parking fares

On-street parking pricing is based on fixed hourly rates of 1 € for approx. 78.000 parking spaces distributed in the territory of the Municipality of Rome inside the Rail Ring. Currently parking policy allow resident citizens having free parking areas with the direct consequence that only the 20 % of parking places is available for paying users. While the fare is fixed, the schedule for payment request in each zone is different. In the following table, the specific articulation is reported.

Appio Latino e Tuscolano	8.00 - 19.00	
Aurelio	8.00 - 19.00	
Borgo	8.00 - 20.00	
Campitelli e Ripa	8.00 - 19.00	
Campo Marzio	8.00 - 23.00	
Castro Pretorio	8.00 - 19.00	Zona Via Cavour - Via Cernaia 8.00 - 23.00
Celio	8.00 - 23.00	Via di S. Giovanni in Laterano 8.00 - 19.00
Della Vittoria	8.00 - 19.00	Lungotevere delle Armi 8.00 - 23.00
Esquilino	8.00 - 19.00	Via Giovanni Giolitti - Via Gioberti 8.00 - 23.00
Flaminio	8.00 - 20.00	
Ludovisi e Sallustiano	8.00 - 23.00	
Lungotevere I e II	8.00 - 23.00	
Monti	8.00 - 19.00	Zona Via dell'Amba Aradam - Via di S. Erasmo 8.00 - 23.00
Nomentano	8.00 - 19.00	
Ostiense X-A e X-B	8.00 - 19.00	
Pinciano	8.00 - 19.00	Corso Italia 8.00 - 23.00
Prati	8.00 - 20.00	Zona Lgt. Mellini - P.za Cavour - Via Crescenzio 8.00 - 23.00
Salario	8.00 - 19.00	
Testaccio	8.00 - 23.00	Via Nicola Zabaglia 20.00 - 23.00
Tiburtino	8.00 - 19.00	Zona: San Lorenzo 8.00 - 23.00
Trastevere + ZTL settore G	8.00 - 23.00	Passeggiata del Gianicolo 8.00 - 19.00
Trieste	8.00 - 19.00	Viale Eritrea - Viale Libia 10.00 - 19.00
Trionfale	8.00 - 19.00	
ZTL senza settore G	18.00 - 23.00	Zona Portico d'Ottavia 8.00 - 23.00

Figure 6 :Day schedule of the application of the on-street payment parking in each zone

At city level the availability of parking places for paying users is diffused, and not concentrated where would serve, where offices are attracting need of parking (public offices, commerce, etc). Up to now, the experience acquired has lead to propose modifications to bring to the on-street parking inside the Rail Ring, in order to improve the conditions of the traffic and environment in the city.

A mapping for the currently priced areas has been realized, as well as for the ones where now the parking is for free, taking into account the so-called "Parking-lackness", distinguished for hour bands.

The modulation of the parking fare according to the different use of the resource made in the different zones of the city, it is necessary. In such way, the on-street payment can effectively represent an instrument for reducing the use of the private vehicle, leaving, on the other hand, availability of places close to offices of general interest, while safeguarding the conditions of the residents.

The reduction of the car number for inhabitant can also be achieved making subject to charge the parking on congested road also for the residents. The way should be a reduced payment, including the burdens supported from the Administration for the release and the management of the permits for the free parking

The feasibility study for the future implementation of a new parking policy is thus based on the introduction of three different parking policies and fares:

- ❖ High fares (up to 2 €) in areas with high commercial activities concentration and low inhabitant density, where high turn- over is expected. No free residential parking is allowed.
- ❖ Limited fares (from 0,5 to 1,5 €) in areas dedicated to resident people. The rule will be the already existing ones with each family receiving two free parking permits. The changes is that exceeding permits will be available, taking into account family dimension and the specific area, but they have to pay 100 Euro a year/permit.

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- ❖ Medium-long term-parking fares (the more you stay the less you pay – from 0,5 to 1,5€ for the first two parking hours or from 2,5 to 3,5€ for the following 9 hours) to be located in areas of edge of the parking zone (so-called proximity parking).

The introduction of the modifications to tariff policies on road should gradually happen, beginning from zones that for user characteristics and attractive points can represent a valid experimentation of such initiative.

M6: Actual implementation:

a. The extension of on-street payment parking places

Only in 2005, the implementation of new on-street parking for about 11.000 parking places was carried out. For instance, a large area of the Trieste neighbourhood has been successfully carried out, thus regulating 3,258 car spaces, 68 parking areas for the disabled, 28 areas for loading and unloading goods and 984 spaces for motorbikes and mopeds. The final decisions were taken in 2003 and in the beginning of 2004: the ultimate revisions are TD n. 1408/03, 2037/03 2074/03 and 159/04 giving the final approval of the scheme and authorising the installation of parking meters, vertical and horizontal signalling as well as they indicate the starting date of the decision. A special office was opened by STA inside the II District Municipal offices in order to support the citizens to know the rules of the new parking regulation and to simplify the request of exemptions. Now, the implementation phase is has been completed.

A new phase was implemented beginning of 2006 in Trieste neighborhood, regulating 1802 car spaces, 54 parking areas for the disabled, 9 areas for loading and unloading goods and 170 spaces for motorbikes and mopeds, in the area including Via Salaria, Via Alfredo Catalani, Via Pietro Mascagni, Via Piccinni, Via di Villa Chigi, Piazza Vescovio, Via Tor Fiorenza. ATAC already sent the free parking permits to the residents in those areas.

Since september 19th 2005, the on street payment parking policy was activated in SAN SABA e RIPA districts, regulating 922 + 1734 car spaces, 20 + 16 parking areas for the disabled, 10 + 9 areas for loading and unloading goods and 34 + 185 spaces for motorbikes and mopeds

These two last areas (San Saba & Ripa) are showed in the following data sheets which inform the citizens.

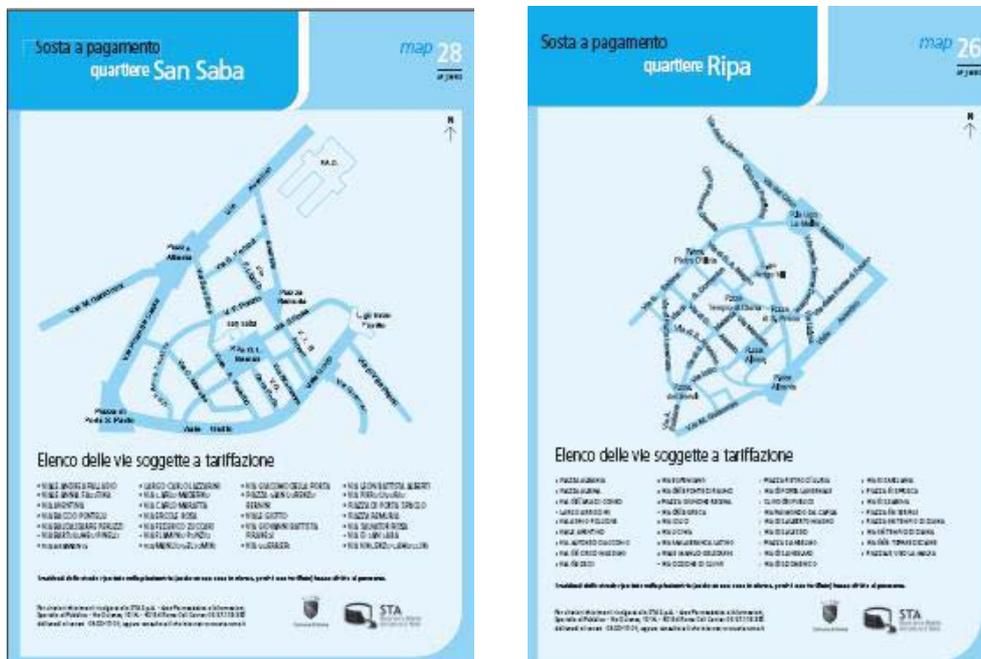


Figure 7: San Saba & Ripa new payment parking areas - data sheets

a1: New payment systems

The **innovation plan** for parking meters achieved during Miracles saw the implementation of 400 STELIO powered by solar cells.

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With regard to the implementation of on-street parking payment with mobile phone issue, STA, published end of 2004 on the Italian Republic Official Journal a Public Tender for an € 2.350.000,00 + VAT for the design, provision, supply in operation and for the management of a payment system for the on-street parking through mobile phones. STA, after the evaluation of the answers received by technological companies, selected Ribes Company, already installing similar systems in Italy, and it will make this new system operative in 2006.

b. Feasibility Study for flexible parking fares

Regarding the flexible parking fare introduction, the feasibility study has been finalized but the measure is suffering the negative opinion of the City Council.

Anyway, the revision of the General Urban Traffic Plan includes such measure and its implementation started with the zones surrounding hospitals, where the parking fare is to be reduced to 0,50 €/hour. At the end of Miracles Project, about 500 parking places are subject to this new fare.

M7: Deviations from the plan:

No deviation occurred from the original implementation plan in the introduction of the on-street parking payment policy in the Laboratory Area. The feasibility study for the introduction of the flexible parking fare was completed and its implementation started.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable. For measure 6.2 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh. and Cost for maintenance.*: removed because such costs were already included in the “cost for operating” indicator

Evaluation category: *Transport*

- *Number of travelled people related to P&R (PT)*: removed because the measure is not directly dealing with P&R structures, located outside the Miracles Laboratory Area

Evaluation category: *Environment*

- *Emissions and concentrations of NOx*: substituted with C6H6 emissions/concentrations because this pollutant, differently from Nox, is a direct impact of traffic, more suitable in case of parking-related pollution analysis

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Given the high number of indicators several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Transport Indicators

A big part of information concerning this measure was carried out directly by STA/ATAC, continuously monitoring the on-street parking evolution in the framework of the Service Contracts stipulated with Rome Municipality. Continuous surveys were carried out by STA in order to follow all the parameters linked to this measure.

For what concerns Public Transport, the ATAC “infopoint” (a GIS based database) continuously provided information on the service. Then, to describe the ex ante phase, most of quantitative information were obtained by existing database, which were continuously updated to collect data available for the ex post phase.

For what concerns the Miracles scenario, transport indicators were defined applying a model methodology. To model the impact of both parking areas’ extension and the introduction of different parking tariffs in II district a

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specific modal split model was defined and calibrated.

It should be noticed that, according to current regulation, parking is free-of-charge for residents. Therefore, the model was applied only to users having their trip's origin outside the II district and destination inside this area. The need to simulate the effects of the introduction of a new option in the target user choice set, represented by the implementation of different parking tariffs currently not existing in the area, made necessary the adoption of the Revealed and Stated Preferences technique. In addition to current user behaviors (revealed preferences, or RP) it was asked to a representative sample of users about their hypothetical choices if different parking tariffs would have been implemented in the destination area. The surveys were carried out in June 2004. Real modal split, used as target to calibrate the specific modal split model was evaluated according to the latest O/D matrixes provided by STA.

The Models: In order to simulate both current traffic flows and cost patterns, a multi-modal user equilibrium assignment was performed, so to evaluate costs (e.g. travel times) for each origin-destination pairs, for each transport mode (car, moped, public transport). The road network graph and the O/D matrixes (car, moped and public transport) were supplied by STA and elaborated by DITS

The supply model: For the supply model the Lazio Region's road network were used in order to provide the most complete representation of the transport network. Such a wide area allowed to deem all trips moving from the whole region to Rome and then to the II District. The network is based on a graph of 8956 links and 854 centroids, 495 of which are representatives of Rome's Municipality area. The link performance functions used in the model were in BPR (Bureau of Public Roads) formulation, where travel time on a link was a function of the link capacity and the traffic condition, i.e. the number of vehicles travelling on the link.

The demand model: Surveys' sample was based on mode choice, each record was weighted on the basis of the available O/D matrixes. The model provided three modal alternatives: car, mopeds and public transport. Walking trips were not taken into account because, due to the specific analysis performed (morning peak hour, trips with destination inside II district) they did not represent a suitable transport alternative. The most recent available O/D matrixes (car, moped and public transport) were used in the simulation in order to target current modal split of users having their trip destination inside II District area; they referred to the morning peak hour. To assess current modal split of target users (trip's origin outside II district and destination inside this area), a specific sub-matrix, one for each transport alternative, was extracted from the complete O/D matrixes (854x854). These sub-matrixes represented all target users (no residents) moving into II District; the number of origin zone¹ was different for each transport modes while the number of destination traffic zone was always equal to 20 (all the II District). Therefore, this methodology led to the identification of the following morning peak hour sub-matrixes:

- car (62x20), some 61,000 total trips;
- moped (62x20), some 25,000 total trips
- public transport (65x20), some 46,000 total trips.

Model calibration: The surveys included both RP and SP. The RPs were used to calibrate the whole utility model, except the parking tariff coefficient, which was obtained by calibrating the SP. The results gathered from the RP were used for representing the utility of the current state. The SPs were based on modifications of the current state obtained by imposing different parking tariffs in the demonstration area (II District). Target modal split was assumed equal to the one obtained by the analyses of the car, moped and public transport sub-matrixes previously described. As expected, calibrating mode choice for trips into the LTZ yielded better demand models than those referring to the general case. This was clearly the result of focusing the analysis on a specific type of trip, which reduces undesired averaging effects. On the other hand, mode choice for not-systematic trips appeared to be easier to model than mode choice for systematic trips.

Other indicators

Economy Indicators came from local partners database.

M9: Achievement of quantifiable targets:

At the beginning of the project was quite difficult to set-up quantifiable targets. Once completed the feasibility studies was possible to look for targets, where only the first one was already mentioned in the DoW.

- 1) Increase the number of on-street parking places inside the Laboratory Area up to 65.000.
- 2) Increase the number of the Park & Ride facility in serving Laboratory Area by 15%

¹ With the term "origin (destination) zone" it is indicated a traffic zone and its relative centroid(s)

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3) Complete the feasibility study for the future implementation of a new parking policy

4) Increase the number of on-street parking meters and set-up of new payment method

M10: Achievement of evaluation-related milestones:

Both the phases process and outcomes concerning

- M1: Extension of parking payment places, particularly in the II District (month 24): fully achieved and overcome in the following months
- M2: Feasibility Study to adopt flexible parking policies: (month 28): completed according the schedule, real application started near public hospitals.

were regularly included in the evaluation process.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) Outcomes coming from the do something scenario, also called Miracles Scenario
- b) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- c) A comparison between quantifiable objectives and actual achieved results

a) The Miracles scenario

This simulation aimed at assessing the impacts on actual modal split of both the extension of parking areas in II District and the introduction of different parking rates in the same area. To assess the relevance of the new modal split model, the comparison between target and "model" modal share is reported in Table 1. Target modal split was calculated by the most recent O/D matrixes and represented the modal split of all users moving into II District, with trip origin outside this area. Results showed that the model was extremely representative; there was a complete correspondence between target and model modal shares.

	Parking tariff	Car	Moped	PT
target	0 €	46.13%	18.68%	35.20%
model	0 €	46.32%	18.24%	35.44%

Table 1– Modal split model target vs. model

The simulation scenarios

The simulation activities focused on the results of both parking areas extension and the different parking tariffs in II District and refer to morning peak hour. Residents were not considered because they were not subject to any parking charge. Target users had their origin outside II District area and destination inside this area. Modal split referred to 3 alternative modes: car, mopeds and public transport; due to target users' characteristics, walking was not considered a suitable transport alternative, as already reported when dealing with the demand model.

Details of the different scenarios that were used to perform simulation analysis are reported in Table 2. Scenario 0 represented the current situation (no parking charge) and it was assumed as reference scenario.

scenario	users	extension parking	hourly tariff
scenario 0	all moving into II district no residents	no	0 €
scenario 1	all moving into II district no residents	yes	1 €
scenario 2	all moving into II district no residents	yes	2 €
scenario 3	all moving into II district no residents	yes	3 €
scenario 4	all moving into II district no residents	yes	5 €

Table 2 – Simulations scenarios

The simulation results

The simulation results reported in table 3 showed the impacts of both the introduction of payment parking and different tariffs; they are expressed both in term of modal split that in variation (Δ) from the current situation (scenario 0).

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Results showed that the introduction of payment parking could produce a modal shift from private car to other transport modes (mopeds and public transport) that varied from a minimum of some 4% (scenario 1) to a maximum of some 20% (scenario 4). Of this percentages, most of the users would move to public transport.

scenario	Parking Tariff (€/h)	Car	Moped	PT	Δ_{car}	Δ_{moped}	Δ_{PT}
scenario 0	0 €	46.3 %	18.2 %	35.4 %	-	-	-
scenario 1	1 €	42.1 %	19.7 %	38.2 %	- 4.2 %	+ 1.4 %	+ 2.8 %
scenario 2	2 €	38.0 %	21.3 %	40.9 %	- 8.3 %	+ 2.8 %	+ 5.5 %
scenario 3	3 €	34.1 %	22.4 %	43.6 %	-12.3 %	+ 4.1 %	+ 8.1 %
scenario 4	5 €	26.7 %	24.8 %	48.4 %	- 19.6 %	+ 6.9 %	+ 13.0 %

Table 3 – Simulations results

In tables 3 and 4 modal share variations due to different parking tariffs are depicted.

Results showed that the introduction of an hourly parking tariffs of 1 € would produce a modal shift from car to other transport mode of some 4% (scenario 1) and this shift would almost double with a 2€/h rate (scenario 2).

Scenarios 3 and 4 showed that the introduction of high parking tariffs (3 and 5€) would produce a very strong reduction in the use of private car, some 12% and almost a 20% reduction was foreseen, respectively.

Therefore, all scenarios showed that approximately 2/3 of the users would move to public transport.

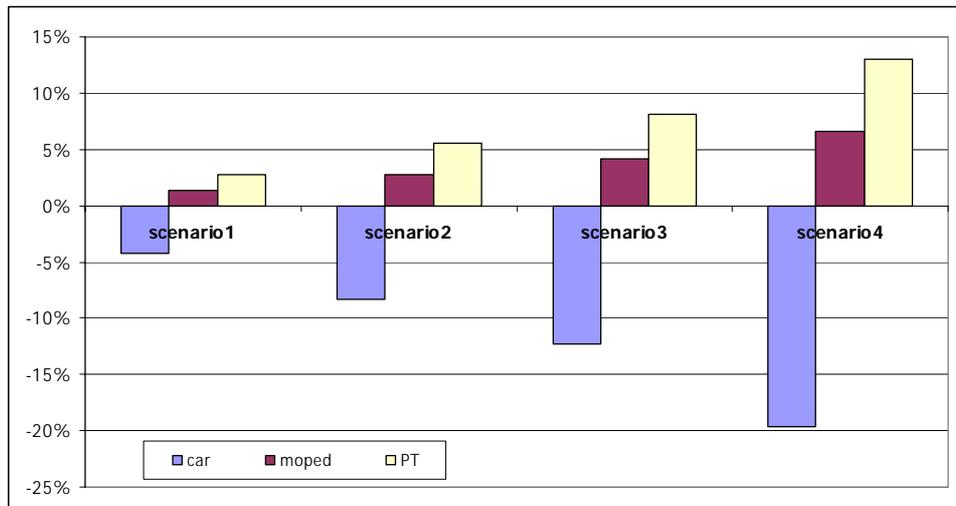


Table 4 – Modal split variation according to different parking tariffs

To provide an example of the number involved by this intervention a general figure of the number of users that would be effected by this measures is given in table 5. It shows, according to actual number of trips moving from outside to II district (some 61,000 during morning peak hour), the number of private car user that would move to moped and public transport.

From these table can be deduced that even applying a parking tariff of 1€ per hour, a reduction of car moving into II district of some 2,500 vehicles could be obtained.

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scenario	car's variation	users	number of cars
scenario 1	- 4.2 %		2,500
scenario 2	- 8.3 %		5,000
scenario 3	-12.3 %		7,400
scenario 4	- 19.6 %		12,000

Table 5 – Number of car's user shifting from car to other transport modes (morning peak hour)

b) The measure outcomes

The measure objective according to the Evaluation plan, i.e. the introduction of on-street parking charges measure, aimed at increasing the number of on-street parking places inside the Laboratory Area, is detectable analysing the achieved results in the fields of Society and Transport. For a synthesis of results, see Table 9.

Society

For this measure, Awareness and Satisfaction indicators were available both for Baseline and ex-post measurements. Awareness indicator did not show any appreciable variations (passing from 91% to 95%), whereas Satisfaction level indicator drops from 3,90 to 3,57 points of a 1-5 Lickert scale for what concerns parking policies linked to P&R, and from 3.30 to 2.52 for what concerns flexible parking rates. The unwillingness to pay and the poor dissemination about future plans for the scheme probably influenced these results.

Transport

The most interesting aspect in this evaluation category was represented by the increased supply of pay for parking lots, which exceeded also what foreseen in the ex ante analyses.

In Figure 8, the increase of on-street payment parking places in the MIRACLES laboratory area during MIRACLES project is reported.

The parking availability increased noticeably, from about 52,000 to 78,727 units, with about 11,000 new spaces being added in 2005 alone. Besides, the number of payment parking spaces related to Park & Ride facilities also increased by 15,5%, up to 12,089 lots in 2004. Even if this result is a collateral one, in the sense that P&R structures are located outside the Laboratory Area, the limitation set out in the MIRACLES area itself, forced people to leave the car outside it, asking for an increase in terms both of pp and number of these P&R structures, that now includes 140 employees and full fare integration with pt (the cost of P&R is free for annual users of pt).

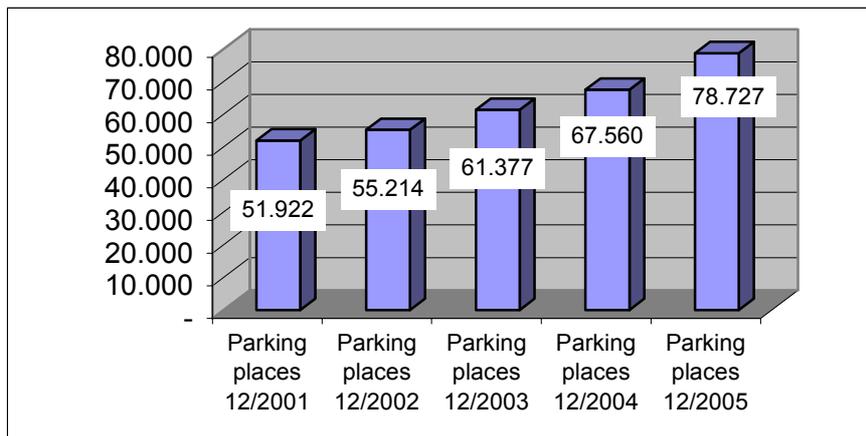


Fig 8: Increase of on-street payment parking places laboratory area during MIRACLES project

In the following table 6 a full economical analysis of the changes during MIRACLES is reported, as well. The revenues from each parking place increased during MIRACLES, passing from 380 €/place per year in 2001 to 430 €/place per year in 2005, in hand with a larger number of parking places, whereas the margin for Rome Municipality increased by 85% in the same period.

MEASURE-LEVEL RESULTS

Measure title: Integrated Pricing Strategies	Project: MIRACLES
Measure number: 6.2 Environmental Parking Charges	City: Rome

	2001	2005
Total Revenues	18,360 MLN€	26,8 MLN€
Mean year income/pp	380 €	430 €
Net income for Rome Municipality	65 €/pp, Total 3,34 MLN €	105 €/pp, Total 6,3 MLN €

Table 6: Main economic data for on-street parking system in Rome.

In the following picture 9 is reported the trend of fines for lack of payment in the years 2003-5. The trend is going down and, consequently, the illegal parking is decreasing.

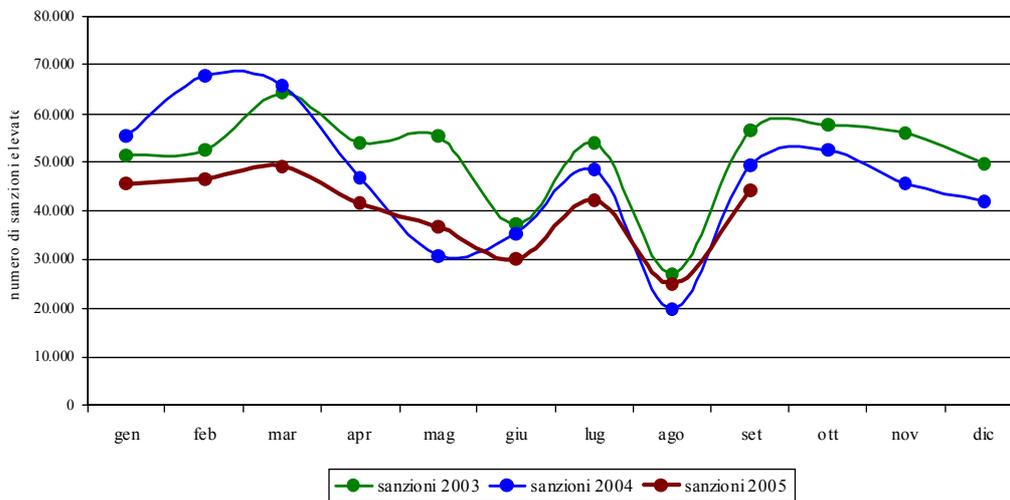


Figure 9: trend of fines for lackness of payment

Moreover, innovation concerned parking meters as well: during Miracles the implementation of the new 400 STELIO powered by solar cells started. In MIRACLES project a relevant change in use towards parking meters instead of the more expensive (for STA) paper ticket was achieved. Figure 10 represents the diffusion of each payment system end of 2005, where a continuous use decrease of the expensive (for ATAC) paper voucher is achieved, going down below than a quarter of the total payments.

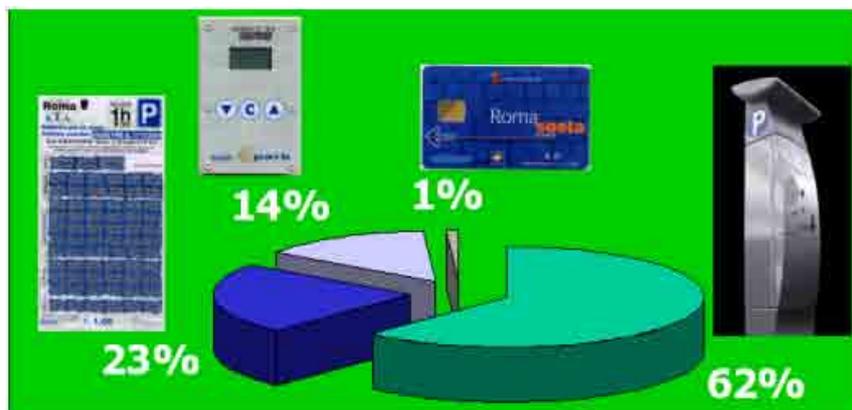


Figure 10: Diffusion of the different payment systems in 2005

The following table represents the ex-ante and ex-post value registered in Rome due to this measure.

MEASURE-LEVEL RESULTS

Measure title: Integrated Pricing Strategies

Project: MIRACLES

Measure number: 6.2 Environmental Parking Charges

City: Rome

Summary WP 6.2 Adoption of policies and environmentally linked parking charges								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.2/Econ.1.a	1	total income from "pay for parking" (€/parking place).	378.11				430.00	No variations foreseen for frozen and trend scenarios
R6.2/Econ.2.a	2	cost for operating (€/parking place)	-				0.10	No variations foreseen for frozen and trend scenarios

Table 7: ex-ante and ex-post measures for Task 6.2

Summary WP 6.2 Adoption of policies and environmentally linked parking charges								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.2/Soc.1.a	14	acceptance	No quantitative data available				Population 2.52 3.33 cluster1 2.57 cluster2 1.77 cluster3 2.61 cluster4 2.08 cluster5	(Likert 1-5) Acceptance = how the satisfaction score takes part of the different clusters of the local culture
R6.2/Soc.2.a	13	Awareness (%)	a)91 b)32				a)95 b)46	a) pricing policy b) P&R
R6.2/Soc.2.b	19	Use motivation	No quantitative data available				96 cluster1 95 cluster2 94 cluster3 92 cluster4 95 cluster5	
R6.2/Soc.3.a		Expectations towards involved agencies/bodies	No quantitative data available				Administration invests in satisfaction for the citizen: -75,6; +24,39; Administration invests in services: -40,99; +59,01 Administration invests in production activities: -7,66; +92,34; Administration invests cultural heritage -13,55; +86,46	
R6.2/Soc.3.b		Satisfaction level (Likert scale point 1 to 5)	a)3.30 b)3.90				a)2.52 b)3.57	a) pricing policy b) P&R Likert scale point 1 to 5; 1: no s., 5 very s.
R6.2/Tan.1.a		pay for parking lots related to P&R (no.)	10214			11624*	12089	No variation foreseen for frozen scenarios * Re-elaborated from data provided to ITEMS
R6.2/Tan.3.a		pay for parking lots (increase/decrease) (no.)	62,000				78,500	STA parking Annual Report 2000 & 2006

Notes:

cluster 1= control, cluster 2= confidence, cluster 3= anarchy, cluster 4= efficiency, cluster 5=mistrust

Table 7 (cont.): ex-ante and ex-post measures for Task 6.2

MEASURE-LEVEL RESULTS

Measure title: Integrated Pricing Strategies

Project: MIRACLES

Measure number: 6.2 Environmental Parking Charges

City: Rome

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase the number of on-street parking places inside the Laboratory Area up to 65.000.	the number of (payment) parking spaces increased from 52,000 to 78,727 units, with about 11,000 new spaces being added in 2005 alone.	The value expected in the DOW was overcome by far. City plans are to reach 120.000 pp subject to payment in few years.	☺☺☺
2) Increase the number of the Park & Ride facility in serving Laboratory Area by 25%	The number of payment parking spaces related to Park & Ride facilities also increased by about 15,5% to 12,089 in 2004		☺☺☺
3) Complete the feasibility study for the future implementation of a new parking policy	Completed but the measure is suffering the negative opinion of the City Council	Anyway started implementation of the reduced tariff near hospitals (0,50 €/h), presently about 500 pp	☺☺
4) Increase the number of on-street parking meters and set-up of new payment method	The innovation plan for parking meters achieved during Miracles saw the implementation of 400 STELIO powered by solar cells.	Public tender published end of 2004 - € 2.350.000,00 + VAT for the design, provision, supply in operation of a payment system for the on-street parking through mobile phones. This new system will be operative in 2006.	☺☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Status of the Measure beyond MIRACLES

The measure (both the subtasks) is going to be completed with some modifications and it will continue beyond MIRACLES.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The City Administration has developed policies aimed at improving mobility, modifying modal split in favour of public transport, increasing traffic safety, decreasing air pollution and acoustic nuisances, regenerating urban spaces, rationalising public space use, safeguarding citizens health, preserving historical and architectural heritage.

This main objective can be detailed in two general goals, i.e. To improve traffic mobility conditions, increasing road safety and decreasing traffic related pollution and To re-qualify urban spaces, rationalising public space, safeguarding citizens' health and life quality, and preserving historical and architectural heritage.

Five areas can be identified in Rome Municipality from a functional point of view, four internal to the Great Ring Road (GRA, Grande Raccordo Anulare) according to the Urban Traffic General Plan (PGTU, Piano Generale del Traffico Urbano), while the fifth is external to the GRA and extends to the city border; all of them have been identified on the base of their general characteristics and the planned modal shift between public and private transport.

To reach these objectives, the City Administration is implementing long term and short term plans. The former refers to the planning and design of main transport infrastructures and the latter to private demand management policies. Among them, the most relevant aim to discourage the inbound traffic, attracted by the business functions locations is the articulation of parking fares: more expensive parking charges getting closer to the city

MEASURE-LEVEL RESULTS

Measure title: Integrated Pricing Strategies

Project: MIRACLES

Measure number: 6.2 Environmental Parking Charges

City: Rome

centre; it aims to encourage the use of peripheral inter-modes nodes.

On-street road parking policy is a driven element of the whole process, in the strong attempt to drive the City of Rome towards a Sustainable development, able to assure its economic growth and attractiveness.

The concerns for poor air quality in these years in Rome, with threshold limit values often not respected, are giving strength to the policies aiming to a re-balance of the modal split towards collective transport and restrictive measures to the private vehicles like the on-street parking pricing are more accepted than ever in Rome.

M13: Interrelationships with other measures

Access restriction (5.1), road pricing (6.1) mobility management (10.2).

M14: Lessons learned

The main lesson learned is that the system can work only if it is integrated with a package of sustainable mobility policies like in Miracles project, to be progressively extended to the whole city.

Consideration needs to be given to the political risk involved in flexible parking charges policies: the application of this plan in large scale much depends on political willingness, on citizens' participation and awareness of this innovative measure benefits.

Communication is fundamental to avoid that this measure is perceived by the citizens like an increased tax for their work.

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8. Measure 7.1 – Safety and Security

MEASURE-LEVEL RESULTS	
Measure title : Improving PT quality and security	Project: MIRACLES
Measure number: 7.1	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>As from Technical Annex: To improve safety and security of PT service within the laboratory area.</p> <p>Actual Objectives:</p> <ul style="list-style-type: none"> ○ Trial of an innovative automatic security and safety video surveillance system in the Termini metro station (the main PT interchange point in Rome), capable to analyse user behaviours through the “understanding” of video information, in order to monitor passengers in the in-door areas of metro and railways stations of the Laboratory Area. ○ Assessment of the system performances 	
M2: Measure description:	
<p>The video surveillance system is based on the application of a computerized image processor based on very complex software. Such system is studied to provide support to the traditional CCTV system manually managed by an operator.</p> <p>The main components of the system implemented in the Laboratory Area comprised the following features:</p> <ol style="list-style-type: none"> 1) A computer system acted as the supervisory system, and provided a user front-end, logging/replay facilities, video capture and routing of video signals to the video processors. This component was known as the “Supervisory Computer”. 2) Software in object form for the Supervisory Computer (user interface, FrameServer driver, communication with Video Processors) as delivered by the PRISMATICA project (GRD1 - 2000 – 10601). 3) A “FrameServer”. This was a video matrix connected to a maximum of sixteen conventional camera signals. One output from this video server was used to display/log all sixteen inputs from the conventional cameras into the Supervisory Computer. 4) Video Processors. These were specialised devices (located inside the Supervisory Computer) that carried out the analysis of video and detected events of interest. Whenever such an event was detected, a message was sent to the Supervisory Computer for it to alert the user and log the event in the system’s database. 5) Software in object form for the Video Processors (event detection, communication with the Supervisory Computer) as delivered by the PRISMATICA project (GRD1 - 2000 – 10601). 6) A S-VHS video recorder. <p>Components (1), (2), (3), (4) and (5) constituted the video surveillance system.</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>Such system substitutes a traditional CCTV system manually managed by an operator. The implementation of such a control room and of an equipment room, where images are processed and stored, is an intervention aimed at improving safety and security in the guarded areas, according to a new concept of surveillance.</p>	
M4: Situation before CIVITAS:	
<p>Before the MIRACLES Project, Termini station was equipped with a traditional CCTV system that allowed only a “direct” manual management by operator.</p>	
M5: Design of the measure:	
<p>The system architecture of the measure is illustrated by Figure 7.1.1. The “Control Room” was a space made available by ATAC where the Supervisory Computer (a tower-size PC with two user screens also housing the video processing boards) and the Frame Server were installed. The room was secured, allowing the equipment to be left unattended.</p>	

MEASURE-LEVEL RESULTS

Measure title : Improving PT quality and security

Project: MIRACLES

Measure number: 7.1

City: Rome

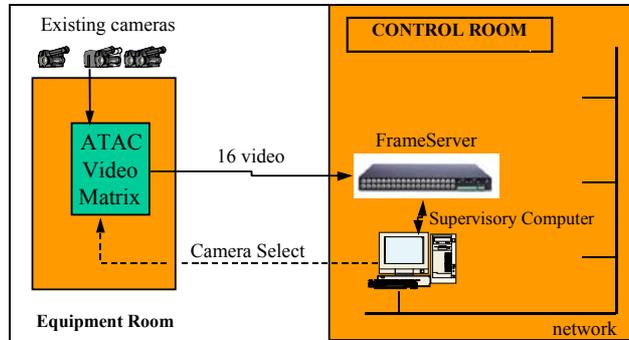


Figure 7.1.1 System architecture

The “Equipment Room” refers to the usual place in stations where video signals converge to switching equipment (video matrices) before they are routed to a monitoring room.

The system

ATAC was responsible for routing sixteen video channels from Equipment Room to the Control Room.

If these video signals originated from the output of an ATAC’s video matrix (i.e. if they could be dynamically selected from a larger number of cameras), ATAC could also provide a connection to select which sixteen cameras were routed to the Control Room at any given time. This connection ended with a conventional video matrix console in the Control Room, for manual selection of cameras, or under the Supervisory Computer control, for automatic or user-controlled selection.

Operating Mode

This sub-section outlines how the Control Room operated.

The first phase was represented by a configuration phase where the user decided which cameras (up to a maximum of 16 cameras) were routed to the Control Room and which five of those should have real-time monitoring. The sixteen cameras were then available for display and digital recording.

The user also defined the type of observation (events, measurements) required for the five monitored cameras, the areas of interest in the images to concentrate the processing, the times of the day for detecting particular events etc. System configuration also included a topological description of the positional relationship between different cameras. This was used so that when an event was detected in a given camera, related (neighbouring) cameras were also displayed as part of the event so that the operator had an immediate overview of the zone.

During normal operation (when operator intervention was not required) the system could simultaneously display up to 16 images (the 16 video signals to the FrameServer) in one of the computer monitors. This was equivalent to conventional CCTV operation.

When an event occurred, the pre- and post-event video was recorded, and the event displayed on the second monitor where the user could respond to the situation.

Event detection

As outlined previously, the dedicated video processors installed inside the Supervisory Computer detected the following events of interest:

- Overcrowding/congestion in semi-open areas (station access, ticketing halls).
- Indication of overcrowding in platforms in terms of discrete categories such as “empty”, “nearly empty”, “nearly full”, “full”).
- Intrusion.
- Stationary people.
- Unusual directions of movement.
- In off-peak situations: localisation and some degree of people tracking within one camera.

For each of the above, upper bounds or restriction criteria were defined; if the system detected a violation of these criteria an alarm message was displayed on the operator PC.

To aid understanding of how the event criteria were defined, an example of the criteria assumed for the event

MEASURE-LEVEL RESULTS

Measure title : Improving PT quality and security

Project: MIRACLES

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“overcrowding/congestion in semi-open areas” is provided in the Figure 7.1.2.

CRITERIA	ALARM MESSAGE
<p>System shall detect – within defined levels – appropriate level of overcrowding/congestion as follows: empty, nearly empty, nearly full, very full, (dangerously) full.</p> <p>Taking into account differences among stations' surfaces it is preferable to define not a criterion for each station but a common criterion for each site:</p> <ul style="list-style-type: none"> <input type="checkbox"/> Empty: (people \leq 2/100 sqm) or (people \leq 15 on the platform) <input type="checkbox"/> nearly empty: people between 3 and 10 per 100 sqm or people less than 40 on the platform <input type="checkbox"/> nearly full (people between 11 and 25 per 100 sqm or people less than 55 on the platform) <input type="checkbox"/> very full (people between 26 and 60 per 100 sqm or people less than 80 on the platform) <input type="checkbox"/> dangerously full: people \geq 61/100 sqm or more than 80 people on the platform. 	<p>The Control Room shall display permanently the crowding level through: visual message or coloured icon (with colour linked to crowding level (white, green, yellow, orange, red).</p> <p>If level detected is (dangerously) full the system must alert the operator until the potentially dangerous situation is ceased.</p>

Figure 7.1.2

Priority scale

To manage the situation of different violations occurring at the same time a priority scale was defined. This assigned to each event a specific priority so that the system was able to inform the operator beginning with the most important event.

An example of the priority list is given in Figure 7.1.3. The list has been organized in a decreasing order: from the most dangerous (priority 1) to the least dangerous (priority 13) event.

Event	Alarm Priority
Violent behaviour	1
Intrusion (people/objects) in no-entry areas	2
Unusually stationary people	3
People/objects beyond the “yellow line” of the platform	4
Unusual paths	5
Objects left unattended	6
People standing or passing through no-exit areas	7
Unusual direction of movement	8
Overcrowding/congestion	9
Graffiti	10
People entering / exiting carriages in an unusual manner	11
People/objects too close to CCTV	12
Theft/sabotage to ticket vending machine	13

Figure 7.1.2

M6: Actual implementation:

The implementation plan of the measure consisted of the following mainly sequential stages (tasks):

Stage 1 - Procurement of Equipment:

The system equipment needed to run the system comprised the following:

- Standard PC running Windows 2000: (the control room supervisory computer).
- 17” Touch Screen computer monitor.
- A 17” computer monitor.
- FrameServer and XpressPlus (FrameServer’s controller card).
- 5 STM1300 Video processors (PC cards).
- S-VHS Video tape recorder for the work to be conducted in the laboratory.

Stage 2- Specification of user’s Requirements:

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This phase can be divided in three sub-activities

- b.1 Specification of a User Interface
- b.2 Definition of events, scripts and system actions

The set of events and measurements (e.g. occupancy levels) to be detected by the system should be highlighted in the “event detection” section (additional events/measurements will depend on technical feasibility and resources).

Specifications defining the events of interest, where/when they happen, who is involved, what are the visual clues that are manually used to determine that the event is occurring were defined in this phase.

- b.3 Select host station and prepare the working environment

The station was identified where the data capture and on-site test would occur in order to allow the setting up of the working environment as described in the measure design section.

Stage 3 - Data (Video) Capture

The objective of this task was to obtain as many video examples as possible of events/measurements that the system was expected to detect/make, using the cameras that would be used throughout the project. This required:

- Working environment as defined earlier.
- Examples that were representative of events of interest to Control Room operators (hence the need to define “scripts” as explained in section b.2).
- Enough examples to give statistical confidence that the algorithms implemented on the Supervisory computer would work when the system was installed. [To give an idea of numbers, it was calculated that for any given event (e.g. detection of an unattended package), it was necessary to capture ~ 350 examples to guarantee that the performance of the algorithms could be measured to a 95% confidence level.]
- Where events were rare, these situations were simulated using properly briefed “actors”.
- Annotation by an expert of what the events were and where they occurred on a video recording.

At the end of this first phase a “Project Data Library” was available.

Stage 4 - Lab design and implementation of user interface and digital video recording

Once the equipment had been procured and installed and a set of requirements/events agreed, work proceeded in the Laboratory to design and implement the user interface (system configuration and event handling).

Digital recording was also designed and implemented. Existing algorithms were tailored to estimate detection performance using the Project Data Library (from previous phase) i.e. this dealt with the front-end of the system and the integration of existing algorithms.

This was seen as an important mid-term milestone in the implementation of the system. This point saw the operation of an integrated system with a user interface, digital recording and detection of some events.

Stage 5 - laboratory verification (refinement of video processing specific to the needs of the project),

This task dealt with any necessary refinements (mainly in video processing, but also in the user interface) to achieve a desired level of performance. At the end of this period, the system was assessed in the Laboratory to formally check that it provided an acceptable level of performance. The system was then implemented on site for the final phases.

Stage 6 - System verification (debugging) on site

This task was fully carried out on-site and involved the technical verification of the system.

Stage 7 - System demonstration

Once the system had been technically verified, it was demonstrated in conditions similar to operational conditions within the selected station. The focus was on usability and dissemination (e.g. to actual operators and potential third-party end-users) and this was assessed during a period of two months.

M7: Deviations from the plan:

Concerning the trial no considerable deviation occurred from the original plan, but slight delays due to technical aspects.

Compared to the outset of the Project the objectives of this task have slightly changed, as described after the 1st Amendment: the initial target of a larger scale implementation has shown to be too ambitious and the objective has been tuned in order to demonstrate and assess the system performances in a complicated environment such as the Termini interchange Station.

Indicators – Deviation from what planned in deliverable 4.1

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The change in the target has also affected the **indicators** dealing with the perception of security referred to this task, the “Society” indicators (Crime rates Acceptance, Use motivation, Awareness and Satisfaction level) which had to be removed.

Evaluation category: *Society*

- *Crime rates*: removed; the indicator was not useful, because it was very difficult to assess whether any MIRACLES measure, or a cluster of them, could be reasonably linked to any variation of security, especially for what concerns measure 7.1 which remained at the trial state.

- *Acceptance, Use motivation, Awareness, Satisfaction level*: removed because the interviewees did not provide a relevant number of replies to build a consistent sample.*

* To be noted that interviewees were asked to answer to questions on telematic devices in general, in which keywords were used: in this case “security”, “safety”, “videosurveillance”, etc.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

1) The measurement and assessment of this task was focused on the capability of the system to automatically detect the events of interest.

The performances of the system have been assessed on the basis of the data collected. These were collected on various visits (4) at different times of the year. Each time the system was left running for about a day.

Detection of overcrowding and congestion were evaluated in a **real-life** environment. While intrusion”, “motionless people”, “motionless objects” and “unusual direction of movements” were evaluated in a **simulation** mode

Then the evaluation was done by comparing the alarm logs with the video logs of the system to determine if the alarms were true positive.

2) DIPPSI have been in charge of the phone interviews with a sample of citizens; questions have been asked on telematic devices in general, in which keywords were used: in this case “security”, “safety”, “video surveillance”, etc.

M9: Achievement of quantifiable targets:

The score of events detected by the video surveillance system was between 81-94%, which makes the system assessable as reliable.

All the details are provided in section M11 a).

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; however the comparison ex ante/ex post was affected by the trial status of the measure, as described in M7.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure’s general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

The general aim of the measure, as described in Deliverable 4.1 – Rome Annex, was to improve safety and security of PT service within the Laboratory Area. This trial measure can be hence considered as a step towards such goal and the evaluation on the outcomes can be mainly qualitative.

For security reasons, detection of overcrowding and congestion were evaluated in a real-life environment, with security manager and operators evaluating the monitoring performance of the system.

“Intrusion”, “motionless people”, “motionless objects” and “unusual direction of movements” were also evaluated in a **simulation** mode, using actors performing the event of interest, while security manager and security operators were evaluating the monitoring performance in the “trial control room”.

Of the events programmed to be detected the overall results were as follows:

- o Overcrowding/Congestion (either too many people or too many stationary people): 94%
- o Abandoned packages (motionless person/object for more than 2 minutes): 87%
- o Loitering (a person in the same area for more than 5 minutes): 82%
- o Intrusion (too close to the edge or intrusion into a forbidden area): 81%

MEASURE-LEVEL RESULTS

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The system was then demonstrated to company management and to security operators and was assessed as reliable and compliant with the system requirements.

In Table 1 the economy indicators are reported. These indicators were meant as a quantitative “hint” to describe the affordability of the measure.

The theoretical costs for maintaining and operating the measure per inhabitant are very low, but since such result Was referred to a trial period, this could be not sufficient to prompt implementers to go on with the measure.

Measure 7.1: Improving PT service quality								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R7.1/Econ.1.a		cost for maintenance of infrastructure (€/inh).	0				€ 25.000 / year € 0.0089 /inh.	The system has been tested in 2003 No variations foreseen for frozen and trend scenarios
R7.1/Econ.2.a	2	cost for operating (€/inh)	0				€150.000 / year € 0.05 /inh	The system has been tested in 2003 No variations foreseen for frozen and trend scenarios

Table 1 - the economy indicators for measure 7.1

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Improve safety and security of PT service within the laboratory area by an optimal use of existing infrastructures, enhancement of video operator efficacy	The score of events detected by the videosurveillance system was between 81-94%, which makes the system assessable as reliable		☺☺
2) Increase the overall Customer Satisfaction Index by 6%	The amount of answers provided by interviewees was not sufficient to build a consistent sample	However, public perception of telematics more generally is good	☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level ☹ difficult to assess ☹ not achieved</p>			

Upscaling - Status of the Measure beyond MIRACLES

The measure has been tested and larger scale implementation has to be agreed by the competent bodies.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Indeed this kind of system can provide cost savings directly related to the scale of deployment; the value of saving is not an absolute value but is related to the security policy implemented and to the dimension of the CCTV network in place.

The system would have delivered its full benefits if it had been designed and implemented as a core element of

MEASURE-LEVEL RESULTS

Measure title: : Improving PT quality and security

Project: MIRACLES

Measure number: 7.1

City: Rome

the security system in its broad sense, and if use of resource of personnel was designed accordingly. Indeed to take the most out of a technological system applied to security in public transport, it is straightforward to "re-engineer" the entire process of "security", therefore taking into account in the design phase all the interrelations between technological support and security personnel. In the case of this trial, the system was just added-on the already existing security process and design of security personnel tasks, distribution alongside the network and quantification.

M13: Interrelationships with other measures

None.

M14: Lessons learned

Besides the economic facet of the problem, the need to operate on a wide area requires also trained personnel and management skills, i.e. time to tune-up the whole system. Once that both the economic and the time issues will be faced and solved, the system will be able to operate at its best, starting to run as a core element of a bigger security system.

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9. Measure 7.2.1 - Multi-modal pre - trip Information

MEASURE-LEVEL RESULTS	
Measure title: Information – Multi modal pre-trip Information	Project: MIRACLES
Measure number: 7.2.1	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>According to the initial objectives: to improve PT information and mobility facilities for multimodal journeys; to increase the number of PT facilities/services users and to improve information for disabled people, these have been achieved through the following <u>operational objectives</u> pursued:</p> <ul style="list-style-type: none"> ○ the provision of detailed information on the existing cycling tracks and paths on ATAC web site; ○ the provision of information on accessible bus stops for the mobility impaired on ATAC web site; 	
M2: Measure description:	
<p>This task has contributed to update the INFOPOINT (ATAC GIS and best routing calculation internet tool), for what concerns bike & ride information and accessibility to the PT according to the following:</p> <ul style="list-style-type: none"> ○ The cycling tracks and paths have been surveyed and pictures have been taken. A new cartographic layer has been designed, implemented in the existing InfoPoint database “connected” to the graph currently on the website and has been made available to the citizens. The work performed has prepared the system to perform the multi-modal calculation (bus-bike-metro etc). ○ The PT stops included in the Laboratory have been scanned and inspected in order to survey the real status of the accessibility for mobility impaired. Information collected is now available on the web site. 	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The integration of the PT data base with bike & ride information and with information on accessibility to the PT services represents the innovative feature of the task.</p>	
M4: Situation before CIVITAS:	
<p>No information on cycling opportunities via internet were available nor information on accessibility to the PT service.</p> <p>ATAC just provided through its Internet gateway the following services:</p> <ul style="list-style-type: none"> ○ best PT routing calculation; ○ best Park & ride routing calculation; ○ Path finding and find the closest POI; ○ Selection and display of interest area such as Municipality and administrative areas of Rome province; ○ Timetables information; ○ PT network service information. 	
M5: Design of the measure:	
<p>The measure design has been based on two actions:</p> <p>1) The first concerning the cycle tracks. All the existing cycling paths and cycling tracks have been surveyed and photographed. The information collected has then been stored on the GIS database in order to be made available for the citizens through the internet.</p> <p>From a technical point of view a new cartographic layer has been created on the GIS for the collection of cycling tracks and pedestrian areas;</p> <p>2) The second action has been focused on the collection of information on PT accessibility for the mobility impaired: a survey of 220 PT stops, including both tramways and bus lines, has been performed and also pictures have been taken; then the data collected have been stored into the GIS, in order to be presented through the Infopoint.</p> <p>The implementation phase has been based on the following steps:</p> <ol style="list-style-type: none"> 1.Existing database analysis; 2.Data collection 3.On-site inspections; 4.Design and accomplishment of the new G.U.I. (Graphical User Interface) module of INFOPOINT; 5.Implementation on a test web-site; 	

MEASURE-LEVEL RESULTS

Measure title: Information – Multi modal pre-trip Information
Measure number: 7.2.1

Project: MIRACLES
City: Roma

- 6. Tool verification;
- 7. Start-up: on-line implementation and coordination between the ATAC GIS and Marketing departments;

M6: Actual implementation:

1) Opportunities for Cycling

As from January 2004 a new INFOPOINT interface for cycle tracks is available INFOPOINT currently provides information on cycling.

On the “Piste Ciclabili” (Cycle Tracks) section, (whose link is **now on the front page of ATAC gateway**), the following is available: information on each cycle track, i.e. exact location of start and finish of the track, length, average run time, and level of difficulty. For each track a large number of photographs is also available.



Figure 1 : A cycle track surveyed

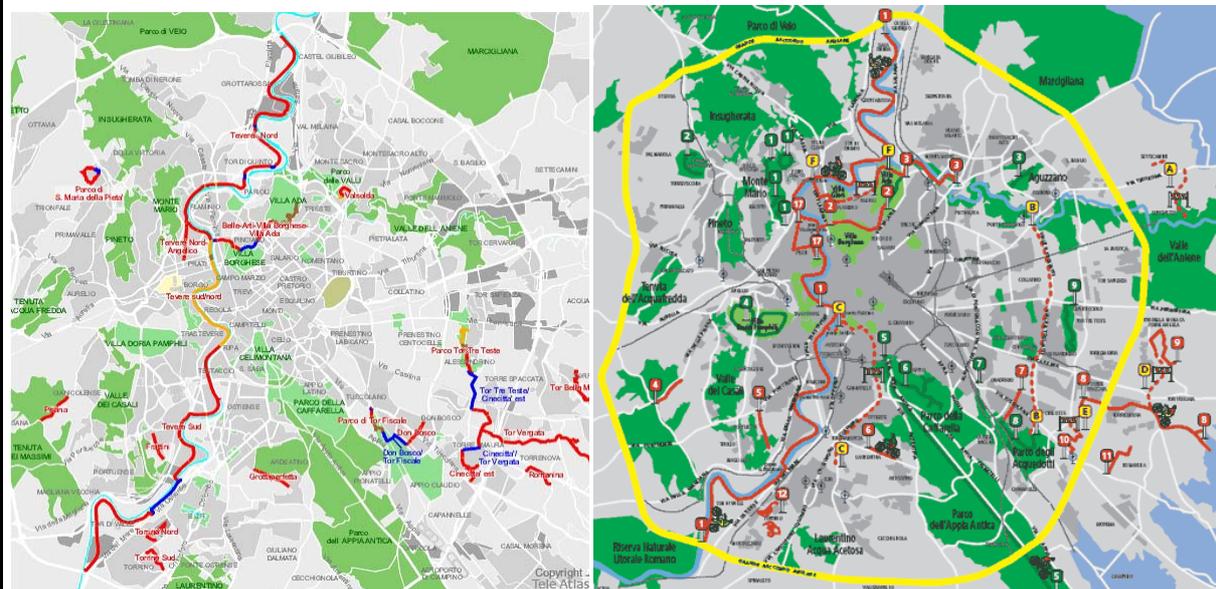


Figure 2: The map of cycling paths provided through internet by ATAC at the outset (2003) and at the end of MIRACLES (2006)

2) Information for the Mobility impaired

The INFOPOINT interface for disabled services has been on line since January 2004, after the test phase.

Information on the accessibility of bus stops has been made available for 220 stops. A detailed description of the level of accessibility to the platforms bus/tram described and depicted as shown in the following picture.

MEASURE-LEVEL RESULTS

Measure title: Information – Multi modal pre-trip Information
Measure number: 7.2.1

Project: MIRACLES
City: Roma

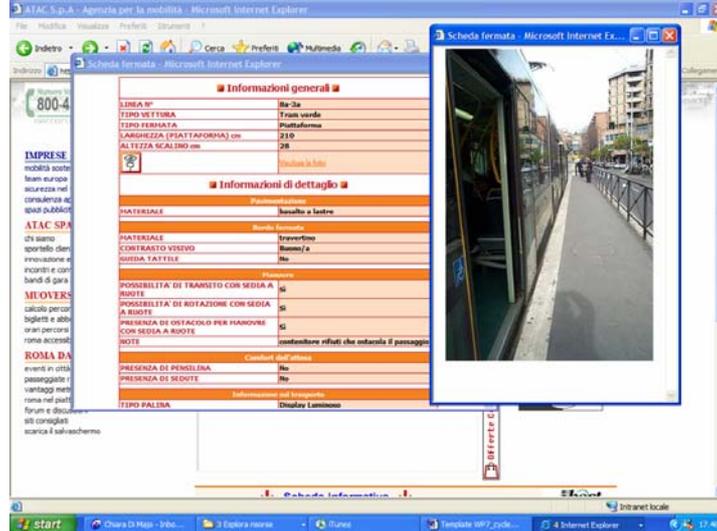


Figure3 – Example of information for mobility impaired provided by ATAC via internet

M7: Deviations from the plan:

No main deviations occurred from the original implementation plan.

Indicators – Deviation from what planned in deliverable 4.1

NA

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

- 1) The performances of each section of ATAC web site is constantly monitored and monthly reports are internally circulated. Thus the main source of information is actually this internal reporting which is based on the logs to the web.
- 2) The “Society” indicators have been provided by DIPPSI that have performed interviews asking questions on telematic devices in general. And also by the “dialog” ATAC has with the associations of disabled.

M9: Achievement of quantifiable targets:

The target was to increase the number of visits to ATAC web site by 3.000 per month.

Actually the increase of visits to ATAC web site from 2002 until 2005 is of the 197%, the average of visitors has been of 204.000 in 2005.

Here follows a summary table showing all the average data collected on the site:

MEDIE	2001	2002	2003	2004	2005	2006
Contacts	3.339.626	7.113.545	14.828.212	23.473.238	32.122.342	24.484.004
Impressions	34.135	1.993.820	2.943.470	4.142.345	5.797.876	6.342.618
Visits	9.819	68.646	102.823	147.468	204.312	147.519

The data on 2006 is partial because referred only to the first 6 months.

A considerable change in the trend of use of the web site can be noticed in 2004, when the visits have almost doubled compared to 2003.

In that period the web site has been partially restyled and more services made available with respect both to the disabled (mobility impaired and special features for visually challenged people), at the same time information on cycling has been added.

It can be noticed that a peak in the visits to the cycling section occurred in June 2005 (fig 5), when a new restyling has been performed and the link to the cycling section has been shifted to the first page. At the same time a good trend of visits during 2006 can be noticed (fig 4).

MEASURE-LEVEL RESULTS

Measure title: Information – Multi modal pre-trip Information
Measure number: 7.2.1

Project: MIRACLES
City: Roma

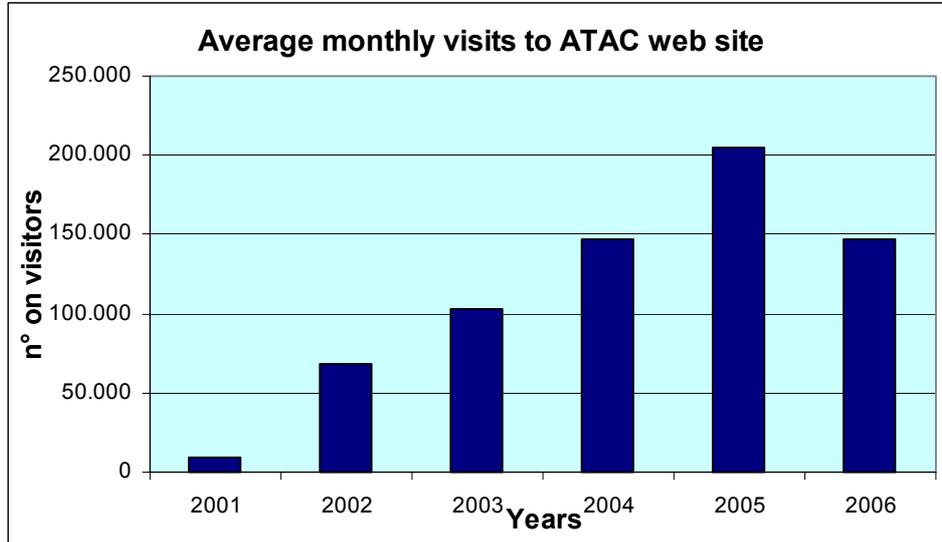


Figure 4 – monthly visits to ATAC web site 2001 -2005/06

Cycling lanes WEB pages

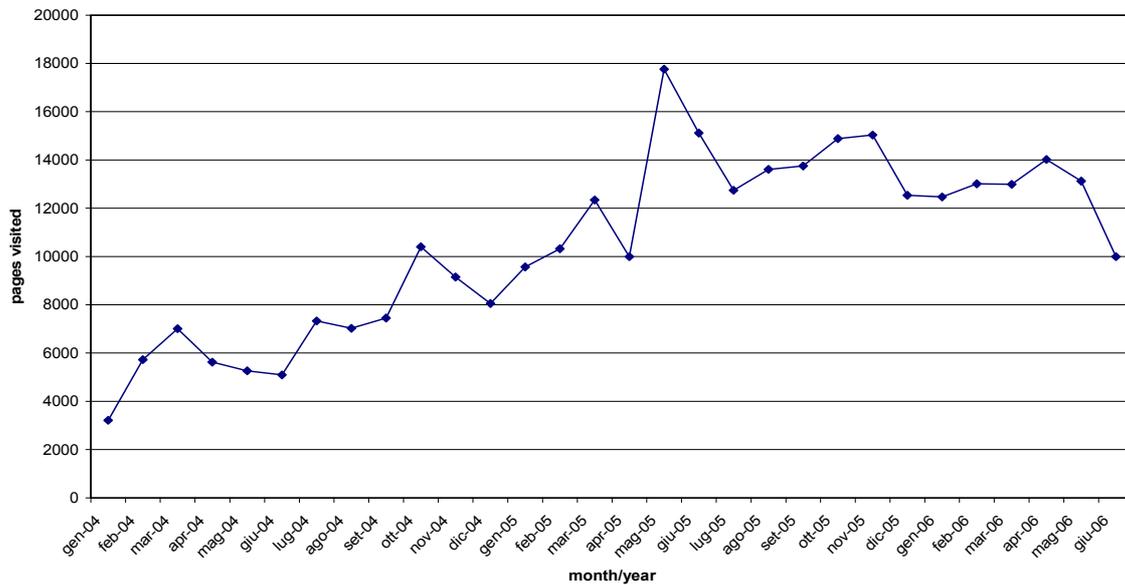


Figure 5 –Visits to cycling information on ATAC web site

MEASURE-LEVEL RESULTS

Measure title: Information – Multi modal pre-trip Information
Measure number: 7.2.1

Project: MIRACLES
City: Roma

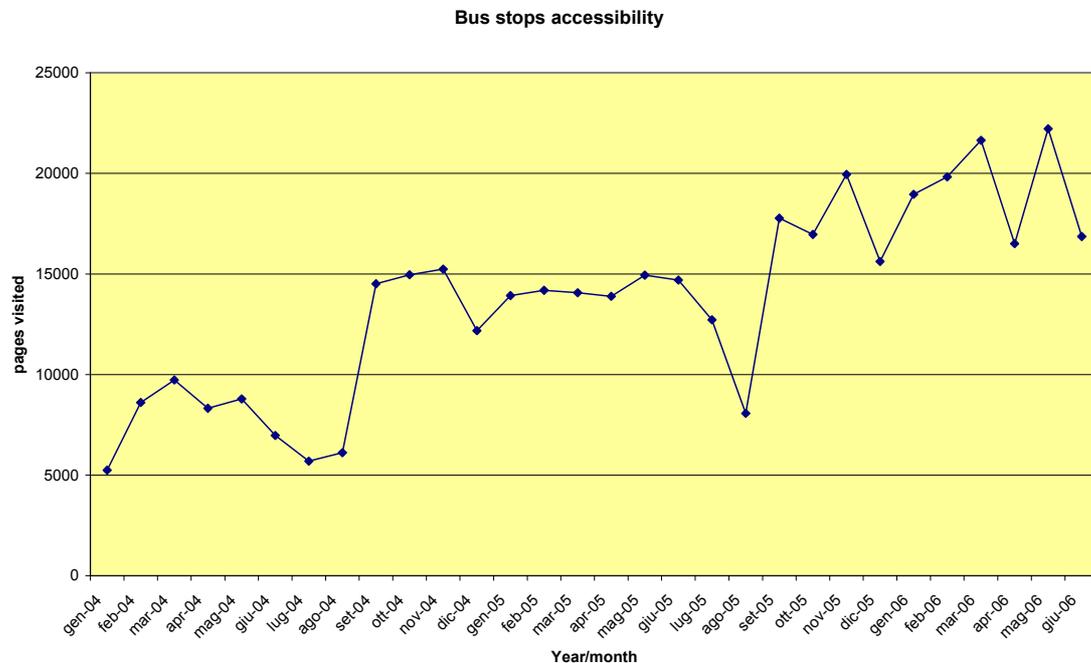


Figure 6 – statistics on visits to bus stops accessibility web site section

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the and evaluation schedule and the implementation process, according to the following phases:

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes - The measure general objectives: i) •To improve PT information and mobility facilities for multimodal journeys; ii) To increase the number of PT facilities/services users; iii)To improve information for disabled people, have been assessed through the society indicators listed at Table 1.

Impacts on how people perceived this new service were very important.

To the ex post 30% increased quantity of information available via media corresponded a substantial increase in the number of visitors on the INFOPOINT website asking for information and news as detailed in section M9.

This aspect went in hand with the general public perception of telematics which was very encouraging.

The second aspect to stress concerns the improvement in the provision of tools for physically challenged people, to get information on mobility which increased noticeably not only for wheelchairs users but also for the visually impaired persons, that had no aids before.

MEASURE-LEVEL RESULTS

Measure title: Information – Multi modal pre-trip Information
Measure number: 7.2.1

Project: MIRACLES
City: Roma

Summary WP 7.2 PT Information								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R7.2/Soc.4.a		Availability of information via internet (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles Since <u>June</u> 2002
R7.2/Soc.4.b		Availability of information via phone (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles Since <u>June</u> 2002
R7.2/Soc.4.c		Availability of information via mail (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles Since <u>June</u> 2002
R7.2/Soc.1.a		Provision for disabled people (no. per type)	995 on board (buses) 88 on board (trams)	No variations foreseen for frozen and trend scenarios			1654 on board (buses) 100 on board (trams) 100 buses with Braille signs	On 2001 ATAC distributed 100,000 CD-Rom with PT info for disabled people
R7.2/Soc.1.b		Visitors on web site for information (n.)	48.000**				200.000***	** Number of visitors of ATAC website in January 2002 *** year 2005

Table 1: ex-ante and ex-post values

b) A comparison between quantifiable objectives and actual achieved results:

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
Increase the number of visits to ATAC website by 3.000 per month.	The number of visitors more than trebled.		☺☺☺
<i>Caption</i>			
☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level			
☹ difficult to assess ☹ not achieved			

Upscaling - Status of the Measure beyond MIRACLES

The measure (including all the subtasks) is currently operative and it will continue beyond MIRACLES

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Neither particular technical nor acceptance problems have been encountered. The main problem was the weather conditions during the field investigation.

M13: Interrelationships with other measures

The task is related with task 7.2.2, since part of the information for the MOBY system is taken from the Infopoint and with task 11.1.3 “Improved network management”.

M14: Lessons learned

The experience performed has shown that there is very good potential for enhancing the system to provide information. In fact the next step, that will be performed after MIRACLES is to implement a multi-modal calculation system, in order to include also the cycling mode in the InfoPoint.

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10. Measure 7.2.2 – MOBY - On board Information

MEASURE-LEVEL RESULTS	
Measure title: MOBY - On Board Information	Project: Miracles
Measure number: 7.2.2	City: Roma
The Measure – what is it about?	
M1: Measure objectives:	
The objective of this task consists in <i>providing PT users with innovative on board information system.</i>	
M2: Measure description:	
The innovative system to provide on board information, developed by ATAC, called MOBY, aims at providing passengers with the following sets information: <ul style="list-style-type: none"> ○ the social-cultural events and the activities in Rome; news from the world; advertising messages; horoscope etc on one side of the screen and ○ information on the PT service, such as points of interest close to each bus stop, intersections with other PT services etc. 	
The Implementation – how was the measure implemented?	
M3: Innovative aspects:	
PT users are provided with a wide range of information on the bus line: route characteristics, interchange points, points of interest for each bus stop (i.e. cinemas, museums, PT offices, etc.), real time variations to the route (due to events, demonstrations, works, etc), on line news;	
The key of success of the project consists in upgrading the customers' travel experiences with punctual information and depends on the features of information provided such as: <ul style="list-style-type: none"> ○ Punctuality: the information searched by customers must be available at the time it is needed; ○ Accessibility: it depends on adoption of easy and friendly media; ○ Attractiveness: achieved adding pleasure to the time spent on the trip; ○ Reliability: it is strategic to inform the citizens as soon as possible about unexpected event in the interest of the community. 	
M4: Situation before CIVITAS:	
Next stop on buses announcement has been performed in experimentation with a small size sample, in order to monitor customer's reactions for further implementations.	
M5: Design of the measure:	
The first step of the Design phase has been the analysis of the information on transportation to be provided on board: <ul style="list-style-type: none"> • The “static” information: routes, timetable and connections to reach hospitals, museums, pharmacies, public offices, etc.; • The “dynamic” information: route deviations, traffic congestion, meteorological events, information on the forthcoming bus stop (for example interchanges, cultural points of interest, hospitals ect; • Information on the different services provided by ATAC: E.g. changes in the business offer and service price list, new payment systems, co-marketing activities with cultural and tourist bodies, organisers of events and shows, etc • Information on Events in town: information on the main cultural and other events and happenings in Rome 	
Form the technical point of view the MOBY System is integrated with ATAC information on two levels (Fig 1): <ul style="list-style-type: none"> Central Data-Centre for the exchange of global data: routes deviations – delays; On board (for the exchange of local data): <ul style="list-style-type: none"> Line, Position, Next stop 	

MEASURE-LEVEL RESULTS

Measure title: MOBY - On Board Information

Project: Miracles

Measure number: 7.2.2

City: Roma

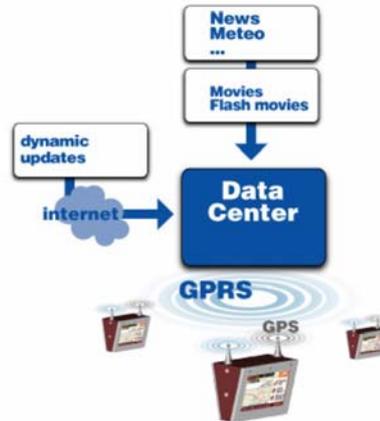


Figure 1 - The information architecture of MOBY

The design phase of the system has also seen an experimental phase. In fact a first test has been carried out over two busses operating on the line 75 depicted below.

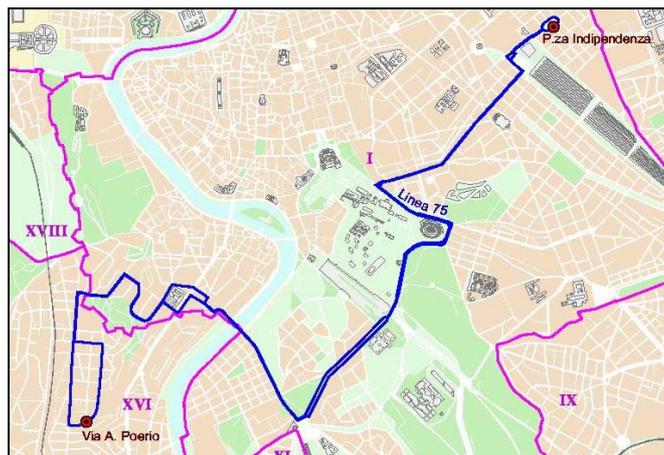


Figure 2 - the first bus line tested

Line 75 has been chosen because it enters the city centre, namely the LTZ. The main component of demand served is formed by tourists; these ones represent the target of the project, because these users are strongly interested in receiving all the information provided by the system.

The test has given good results especially on the system reliability, it was decided then to go ahead with the large scale implementation.

The choice of the bus lines interested by the services has been conducted on the basis of the following criteria:

the **target** to serve: the non-systematic user (tourists);

the **area** of interests: in addition to the historical centre, also areas hosting important events;

the **vehicles**: the buses, or vehicles in general, have to be considered technically suitable to install the **equipment**:

- properly designed to serve the target demand: dimensions, comforts capacity;
- properly designed to be equipped: capable to absorb vibration, controlled temperature,
- properly designed to hold the equipment in terms of space and general conditions;
- route: involving areas with a good signal reception and with roads suitable paved for equipment of vehicles.

MEASURE-LEVEL RESULTS

Measure title: MOBY - On Board Information

Project: Miracles

Measure number: 7.2.2

City: Roma

M6: Actual implementation:

The MOBY system is now implemented on the 200 new buses (ref WP12) which are running on bus lines included inside the Laboratory Area, according to what described in the Technical Annex, anyway the actual implementation has gone further beyond that number, in fact as from March 31st 2006 the buses equipped with the MOBY system are **450** in the whole city.

The Implementation has been achieved through the following steps:

Step 1 - Purchase of the equipment

Videos and equipment had to satisfy some specific requirements due to the special use; the vehicles operate in quite hard condition for electronic tools such as vibration and high temperature.

Step 2 - Mapping of the operating area.

A complete and detailed structured map of area attractiveness (services, events, etc) and of transportation network (services, connection, interchanges terminals, etc) has been carried out.

The information is available via web site, and is updated with temporary events, and transferred to the vehicle.

Step 3 - Set up of an internal (ATAC) editorial staff

A dedicated task force has been set up in order to manage and plan the “programme schedule”, and to update Information in real time during the trial.

Step 4 – System running

The Moby system is operated by an external company. The operating costs are incurred by this external operator and are covered with the revenues from the management of the advertising spaces.

The “TV programme” is available 18 hours per day from 5.30 am until 11.30 pm through cycles of 20 minutes repeated

The following topics are proposed:



Moby News: information in real time on the latest events



Moby Horoscope



Moby Sport



Moby Cinema: latest updates on the upcoming movies



Moby Meteo: national and regional weather forecast for the next 24 hours



Discovering Roma: information on the monuments and parks in Rome



Roma Events : daily information on any happenings in Rome



Atac Informs: Information on Public Transport Services



Moby Nature: information on oasis and parks



Municipality of Rome
Information Spots by the Municipality of Rome

Advertising Spaces are also available

MEASURE-LEVEL RESULTS

Measure title: MOBY - On Board Information

Project: Miracles

Measure number: 7.2.2

City: Roma



Figure 3 - The MOBY on board equipment.

M7: Deviations from the plan:

The original target of providing VMS devices onto the 18 mt buses has been enhanced and improved by far compared to the initial targets.

Traditional VMS have been substituted with the video depicted above, providing a wide range of information, and using innovative technologies. This change has been outlined in the 1st Amendment.

Indicators – Deviation from what planned in deliverable 4.1

For measures 7.2 deviations occurred to the Society Indicators – *Acceptance, Use motivation and Expectations towards involved bodies*: removed because the interviews carried out by DIPPSI could not provide a relevant number of replies to set up a consistent sample.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

- 1) Data on the costs and implementation of the videos came from ATAC balance sheet and reports.
- 2) Interviews have been performed by DIPPSI asking questions on telematic devices in general.
- 3) ATAC periodically monitors the Customer Satisfaction Index on the quality of information provided.

M9: Achievement of quantifiable targets:

All the 200 videos have been installed according to the plans and will soon reach a total of **450.**, these should meet the requirement of “Increase overall Customer Satisfaction Index (CSI) by 6%”

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure’s general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

The measure goal i.e. “To improve the quality of on-board multi-modal information”, as stated in Deliverable 4.1 – Rome Annex, has been achieved. Indeed, the 200 new videos were a very innovative feature on the transit supply, because before MIRACLES no on-board information was available (see Table 1). Moreover, the quality of information itself is very good; besides breaking news, information on events (exhibitions, entertainments, etc.), horoscopes, the media service provides information on routes, timetable and connections to reach main public and private facilities (hospitals, museums, public offices).

However, the public perception of the service was very difficult to assess though the methodology proposed by DIPPSI, in fact interviewees did not provide a relevant number of replies on the subject such to allow to set up a consistent sample on “use motivation and acceptance”. Anyway ATAC has surveyed the perception of the information provided to the citizens and, although MOBY is not yet so widespread, the perception surveyed was so good that it has been decided to enhance the service provided.

MEASURE-LEVEL RESULTS

Measure title: MOBY - On Board Information

Project: Miracles

Measure number: 7.2.2

City: Roma

Economy: the data on costs for operating came from ATAC records (reports and invoices)

Summary WP 7.2 PT Information								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R7.2/Tran. 1.a		real time information panels on board (n.)	171 on BUS 30 on Tramway 0 video				200 videos on BUS	No variations foreseen for frozen and trend

Table 1: ex-ante and ex-post values

The data on the base year refer to old VMS devices, experimented in occasion of the Jubilee, which just provided information on next stop. These have then been substituted with the innovative videos.

b) A comparison between quantifiable objectives and actual achieved results:

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
Increase the overall Customer Satisfaction Index (ICS) by 6%	Although the amount of answers provided to DIPPSI by interviewees was not sufficient to build a consistent sample, in general the ICS on the quality of information provided has increased.	The system is considered successful and has been actually implemented beyond the original target	☺☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Up scaling - Status of the Measure beyond MIRACLES

The measure has been tested and it will continue beyond MIRACLES. All the buses purchased from now on will have to be equipped with the MOBY system.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

NA

M13: Interrelationships with other measures

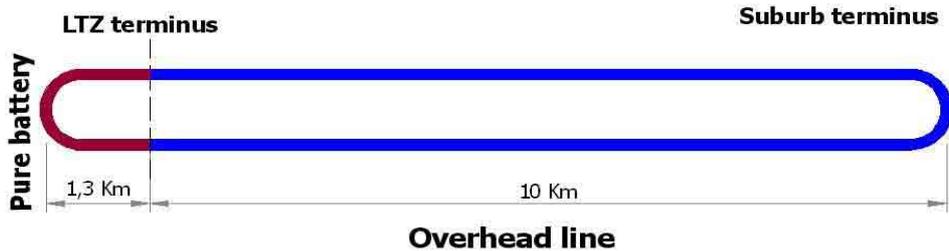
The measure is strictly linked to Task 12.1 “clean buses”, and to task 7.2.1, in fact the geographic information provided through MOBY come from the GIS of ATAC.

M14: Lessons learned

This measure has shown to be successful either because of the information provided and for the “project financing” way chosen for paying the system itself (operating costs covered by revenues from advertising spaces) which is all in charge to an external company.

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11. Measure 7.3 – Introduction of New Lines

MEASURE-LEVEL RESULTS	
Measure title: Introduction of new lines	Project: MIRACLES
Measure number: 7.3	City: Roma
The Measure – what is it about?	
M1: Measure objectives:	
<p>The general objective of the measure: <i>to extend the PT network supply within the Laboratory area</i>, has been achieved through the following instrumental objectives:</p> <ul style="list-style-type: none"> ○ Design and Implementation of an electric bus line in the Trastevere LTZ; ○ Design and Implementation of an electric bus operated line in San Lorenzo LTZ; ○ Design and Implementation of a new Trolley line to substitute n° 90 express bus line. ○ Re-styling and adaptation of a former bus depot to a Trolley depot (called “Montesacro”). ○ Comply with the environmental constrains 	
M2: Measure description:	
<p>This measure has been developed in strict co-operation with measures 5.1 and 12.1, i.e. Access Restrictions and Clean Vehicles.</p> <p>The introduction of the two new electric bus lines in “Trastevere” and in “San Lorenzo” (see task 5.1) has been designed according to the plan issued by the City Council for introducing limitations to traffic in these two areas, characterised by a high density of clubs, restaurants, pubs etc, which cause problems of noise, congestion and pollution during the night hours.</p> <p>The “Limited Traffic Zone” policy during the night time has been implemented at the same time as the provision of a dedicated and low emission collective transport service. The first enlargement of the electric bus fleet in 2003 (see task 12.1) has made it possible, the two lines n°141 and n°125 have also been given a nick name, “Nottambula”</p> <p>On the other hand the second aspect of this measure has dealt with the implementation of a new trolleybus line n° 90, along one of the main corridors linking the suburbs to the city centre, Via Nomentana. (the City Council itself has afforded a cost of about 40 million Euros for this line).</p>	
The Implementation – how was the measure implemented?	
M3: Innovative aspects:	
<ul style="list-style-type: none"> ○ the usage of electric buses as shuttles inside the night time LTZ for the P&R system; ○ the innovative trolley line, depot and plants implementation, ie.: electric plants optimisation and integration, depot restyling, optimisation of the visual impact of the aerial wire along the line, re-design of the stops, restyling of the road platform, design of the suburb terminus and purchase of the vehicles (task 12.1); ○ innovation concerning the new Trolley line also consists in the total absence of aerial wire network when entering the city centre, the traction here is guaranteed by the batteries; 	
	
Fig. 1 - a scheme of the trolley line	
<ul style="list-style-type: none"> ○ the design of the new lines has been performed with particular respect to the environmental standards that focus both on the concentration of pollutants (especially particulate – PM10 and benzene) and noise. ○ The identification of area where the commercial activities causes a great increase of pollution and noise due to road traffic, difficulties in parking, with peaks during the night hours. 	
M4: Situation before CIVITAS:	
<ul style="list-style-type: none"> ○ Electric buses have been running in Rome since 1989, and since 1996 a quite large fleet of 42 buses has been operating on three lines with a total production of 1,200,000 vehicle-km per year, (which means about 1% of the service offered by the surface network). ○ No preliminary works or implantations for a Trolleybus line had been made before MIRACLES; nevertheless in 	

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

Measure number: 7.3

City: Roma

Rome the trolleybus used to run four lines between the forties and the sixties.

- Since 1999 the PT network has been reorganised, in order to have implemented the **Express** bus lines (high capacity, high frequency, few stops, operated along main transport corridors), the trolley line has been designed to be implemented on the 90 express line

M5: Design of the measure:

1) The project for the introduction of new electric bus lines has affected the areas of Trastevere and S.Lorenzo, covering the 1st and the 3rd districts, respectively depicted below.

The **line 125 Nottambula** has been designed with the aim to integrate the network of electrical minibuses previously operating on the historical centre. The pre-existing network was based on

- Line 116 linking Via Veneto to San Gallo
- Line 117: connecting S. Giovanni in Laterano square with Via del Corso;
- Line 119: a circle line with terminus in Via del Corso;

The **line 141 Nottambula** is a line established in San Lorenzo in close coordination with the access restrictions measures during the night time.

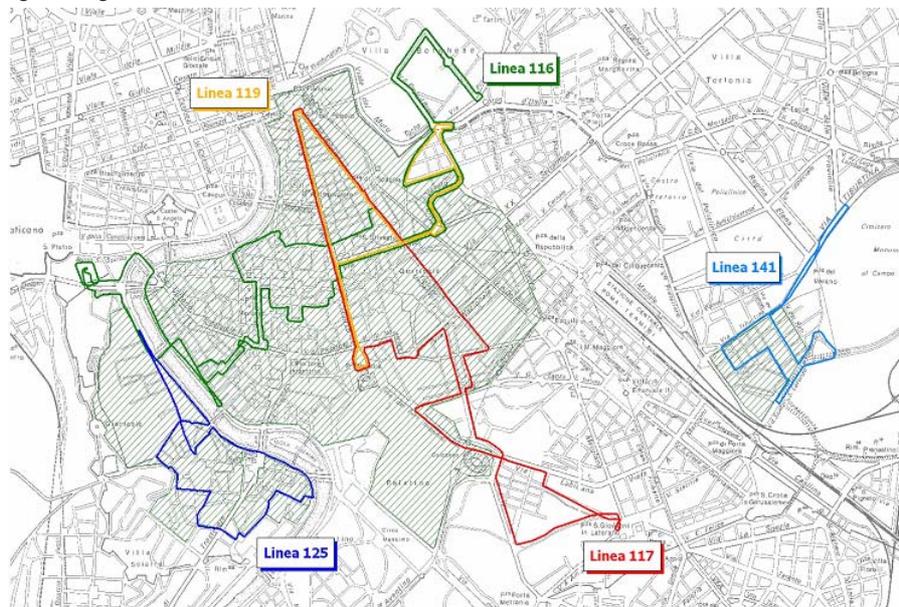


Fig 2 - The electric bus network

2) The new Trolley line has been designed with the purpose of **substituting** the 90 **Express** bus line, thus guaranteeing high capacity in order to serve great flows during the peak hour for quite long urban trips and also high commercial speed, in order to offer reduce travel times;

This line has also been designed with the aim of improving the accessibility to the centre for people moving from a suburban area with high density of population.

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

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City: Roma

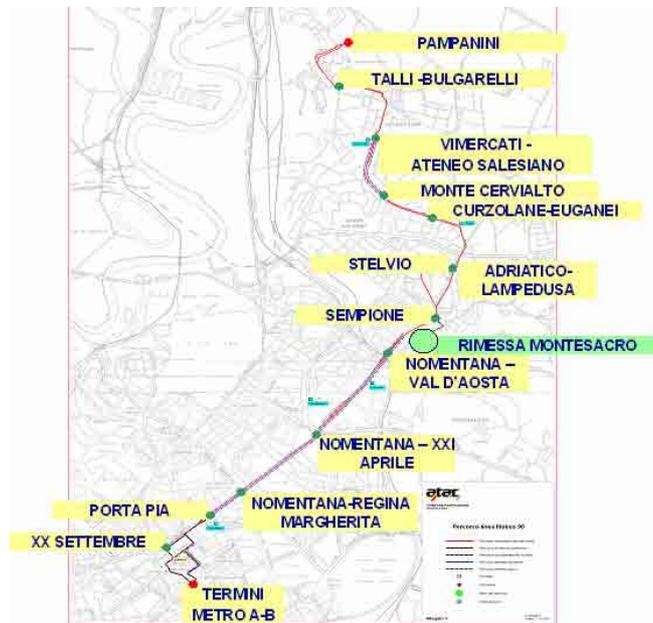


Figure 3 - Design of line n°90

The new line has been designed to have 33 stops (considering the round trip) and for a total length of 22,8 km (round trip), almost all the pathway is in protected lane. More details follow in the next section.

3) The introduction of the Trolley line has also been carried out through the re-design and adaptation of a former bus depot to a **Trolley depot**.

The Montesacro depot used to be the recover of the trolleys until the sixties, and is located in a valuable area of the city, which also includes some archaeological ruins, so particular care has been put in the building and planning details in order to reduce the noise levels.

M6: Actual implementation:

Step 1 - 2 new electric bus lines are in operation since June 2003 so today the current “electric bus network” is operated with 52 vehicles has a total of 5 lines and covers 52 km.

The electric bus network now performs the following level of service:

- 1.215.941 vehicle/km per year (2004)
- 8 million passengers per year (2004)

125 line links **Trastevere** with the Gianicolo parking, offering a P&R service both to visitors and residents and is completely integrated with the pre-existing network.

At the same time this line is integrated in the night time LTZ system which provides a small shuttle network linking the four main parking areas with the heart of Trastevere, this local night network also integrates the tramway line n°8, the electric bus and also provides links with the metro B line and the Trastevere train Station, as depicted in the following figure.

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

Measure number: 7.3

City: Roma

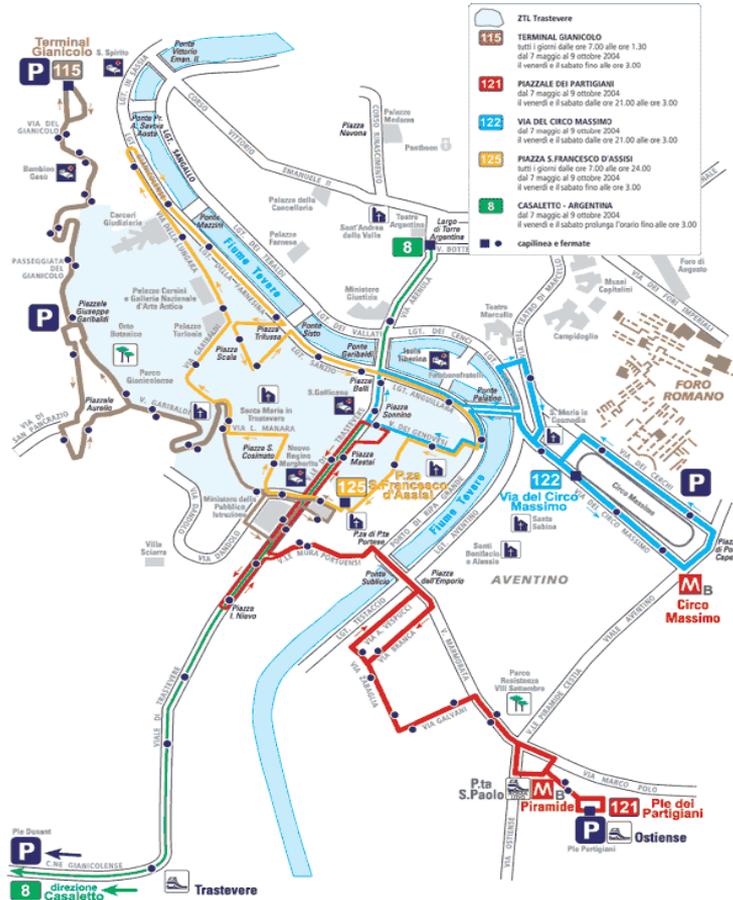


Figure 4 - Trastevere LTZ – PT system

HIGHLIGHT – unexpected achievement: on 12th January 2006 the new **Park & Ride** in Trastevere has been inaugurated. The construction of the parking has been very long lasting, since it is situated in an area with a rich archaeological soil. Many times the works have been stopped by new findings. In fact because of its uncertain completion this parking it had not been included amongst the MIRACLES objectives.

The archaeological findings (in particular mosaics) are now adorning the parking, which can host up to 221 cars with a tariff of 1€/hour.

This parking supports the LTZ already implemented in Trastevere, further to this the route of the electric line n°125 has been re-adapted in order to connect the two parking: Trastevere and Gianicolo.

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

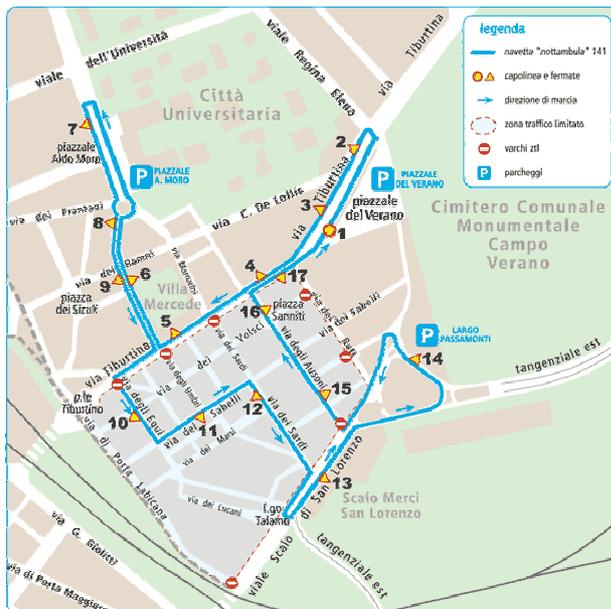
Measure number: 7.3

City: Roma



Figure 5- the updated route of line 125 (since January 2006)

The 141 line serves S.Lorenzo providing a shuttle service from boundary parking areas is the only one not integrated in the network as can be noticed in the picture above, nevertheless it provides the necessary shuttle service as shown below, which also provides an example of the elements that set up the integrated planning of the San Lorenzo LTZ, indicating:



- the bus line;
- the parking areas;
- the traffic limits;
- the LTZ itself with denied accesses.

Fig 6 - San Lorenzo LTZ system

Step 2 - The Trolley line n°90 has been inaugurated on the 23rd of March 2005. here follow the main technical features of the line:

MEASURE-LEVEL RESULTS

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TECHNICAL FEATURES OF THE LINE

LENGTH OF THE LINE (round trip)	22,8 Km
Number of stops (round trip)	33
Commercial Speed	15 Km/h
demand	2.500 pass/h
Interval	4'
Battery operated lenght	3.2 km
Electricity Supply	750Vcc
Number of rides per day	217

Here is depicted the leaflet now available to all the Roman citizens showing the Trolley pathway



Fig 7 – the trolleybus line 90

The advantages derived by the introduction of the Trolleybuses are the following:

- Availability of a high percentage of protected tracking
- Proximity of the depot to the line (800 m approx. no overhead electricity is available)
- Reduced incidence of the battery operated section, 15% of the total path;
- Possible utilization of fixed installations for new lines to be introduced in future
- Re-qualification of the bus stops

The **overhead wire system posts have been unified with those of the public lighting** in order to reduce the visual impact, as shown below the difference between the ante and the post situation can hardly be perceived:

MEASURE-LEVEL RESULTS

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City: Roma



Torlonia "before"



Torlonia "post"

Figure 9 – before and after the installation of the overhead line

Concerning the operation of the line it is worth to highlight again the double possibility to operate both with the overhead line and just with batteries.

Since there's no point of electrical charge at the St.Termini. Terminal, actually the vehicle is battery operated for 1.6+1.6 that is 3.2 km.

When the vehicle approaches Porta Pia, the batteries are fully charged – 100%; then the vehicle is battery operated for 3.2 km (1.6, stop at termini, 1.6) and when it reaches Porta Pia again the battery charge level is ABOUT 70%

Concerning the **depot**, a special attention has been used in order to reduce noise due to machines inside the plant: the value of noise will be largely under 55-65 decibels during the day, and 50-60 decibels during the night.

M7: Deviations from the plan:

More or less 6 months delay in the final implementation of the Trolley line. This was due to some minor delays in the delivery of the vehicles and in the talks with all the public bodies concerned with the "construction" of the line along Via Nomentana.

Indicators – Deviation from what planned in deliverable 4.1

For measure 7.3 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for maintenance and Cost for operating:* removed because these data are property of the Company TRAMBUS (in task 12.1 details on cost for maintenance for the vehicles is provided)

- *Income for PT sold tickets:* removed because the data available on revenues from ticket sales include all the tickets sold (BIT and the passes,) and it is not possible to extract the income for specific lines.

Evaluation category: *Environment*

- *Emissions of NOx:* substituted with C₆H₆ (benzene) emissions because more relevant

- *Concentrations of NOx:* substituted with C₆H₆ concentrations because more relevant

MEASURE-LEVEL RESULTS	
Measure title: Introduction of new lines	Project: MIRACLES
Measure number: 7.3	City: Roma
Evaluation category: <i>Society</i> - <i>Awareness and Satisfaction level</i> : added Evaluation category: <i>Transport</i> - <i>Journey time and Travelled people</i> : added	
The Evaluation – how was it done and what are the results?	
M8: Method of measurement:	
Given the high number of indicators several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.	
<u>Environment indicators</u>	
Information on environment came from air quality assessments concerning the emissions of CO, particulate and benzene. In this case, for the ex ante evaluation, data from the HEAVEN project were used; in particular the TEE model, supplied by ENEA, calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry.	
For what concerned concentrations, indicators about CO, particulate and benzene were studied; moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration were carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution was available. In particular, air quality data were acquired by the monitoring stations of the laboratory area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives. Benzene was measured by a passive samplers method, i.e. the Radiello® diffusive sampler; these are samplers in which the diffusive and absorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially and parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface. The BTEX, sampled in urban environment by the cartridge are thermally desorbed.	
<u>Society indicators</u>	
The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.	
<u>Transport Indicators</u>	
For what concerns Public Transport, ATAC, the Agency for mobility in Rome has provided all the information available: information concerning the PT lines are monitored and provided by the “Planning Department” which periodically reports on the level of service.	
For what concerns the Miracles scenario, transport indicators were defined applying a model methodology.	
The introduction of traffic restriction schemes in Trastevere and S. Lorenzo districts in combination with new bus services, implied a new modal split and flow distribution that were estimated through traffic simulation in application 5.1 – <i>Set-up of city centre clean zones</i> . For bus users estimation, O/D matrices and results from this simulation were taken into account to evaluate impacts of the new bus services.	
Three different scenarios taken into account for the assessment were:	
<ul style="list-style-type: none"> • “Without” traffic restrictions in S. Lorenzo and Trastevere districts • “With” traffic restriction and new electric buses supplying Trastevere and S. Lorenzo districts. • “With” traffic restriction and conventional buses used to serve the two zones. 	
The scenarios referred to the period from 21:00 to 22:00.	
Distance covered by not authorised car users by car (<i>without</i> traffic restrictions) and by bus (<i>with</i> traffic restrictions) from boundary parking area to the LTZ was considered for impacts evaluation.	
The following assumptions were made, as well:	
<ul style="list-style-type: none"> • In traffic restriction scenarios, not authorised car users going to LTZ left their vehicles in parking areas on the boundary of LTZ and take new buses. 	

MEASURE-LEVEL RESULTS

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- The distance covered by not authorised car users to reach their destination in the LTZ from parking areas was estimated.

Due to the presence of police control in access points, the number of vehicles violating traffic restrictions was considered negligible.

M9: Achievement of quantifiable targets:

- 3 new PT lines have been implemented, operated with ZEV vehicles. 22,8 Km trolleybus line + 2 new electric bus lines which enlarge the electric bus network up to 52 km;
- For what concerns the “society” aspects it must be highlighted that, following the research made by DIPPSI according to the methodology described above, the awareness level on “clean transport” has considerably increased (from 53 to 76 %) as well as the satisfaction level
- Furthermore, it has been recorded, at city level, an increase by 6.1% of the PT surface network, and an increase by 5.5% of the number of PT lines.

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule, in particular the following objectives have been achieved and overcome:

- Increase by 25 km the electric (bus/trolley) network inside the Laboratory area.
- Increase the number of e-buses users by 200.000 pax/month at city level;
- Increase the overall Customer Satisfaction Index (CSI) by 6%;
- Contribute to increase the PT supply in Rome (see section M9)

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- Outcomes of the “do something scenario”, also called Miracles Scenario
- The measure outcomes, according to evaluation categories and indicators and to the measure’s general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- A comparison between quantifiable objectives and actual achieved results.

a) The MIRACLES Scenario

Background

Rome municipality, with the aim to reduce traffic congestion on weekend nights and to make Trastevere and S. Lorenzo districts better liveable places, implemented a Limited Traffic Zone (LTZ) in these areas. Streets inside the LTZ can be travelled only by residents and authorised users (all details in task 5.1 b)

With the introduction of this measure, specific bus lines, one in S. Lorenzo and four in Trastevere, were introduced as well, providing shuttle service from parking areas in the surroundings of the LTZ.

1) For the same reason, four new lines (125 – 115 – 121 – 122) were activated to serve **Trastevere LTZ**. All of them provide shuttle service for P&R areas close to the LTZ, and line 125 is operated with electric buses. For the details of the lines routes refer to figures 4 and 5:

2) During the LTZ restrictions in **S. Lorenzo** specific parking places located in largo Passamonti and piazzale del Verano were identified and a dedicated bus line (n° 141) was activated, with a frequency of ten minutes (see figure 6)

This **simulation**, hence, aimed at assessing impacts, in term of vehicles emissions, of the introduction of these new bus lines in Trastevere and S. Lorenzo LTZ on environment.

Results

Impacts in terms of emissions were calculated on the basis of total distance covered by car and by bus to go from surrounding parking areas to the LTZs using the TEE software. In table 3 and table 4 the number of non authorised car users going to LTZ from 21:00 to 22:00 and number of trips for each bus line are shown.

The global distance covered by cars and buses in reference period is also reported.

	Trips (reference period)	Vehicle-Km-hour
Cars	162	129,3
Bus 141	24	55,2

Table 3 – Distance covered by cars and buses in S. Lorenzo

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

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City: Roma

	Trips (reference period)	Vehicle-Km-hour
Cars	261	563,4
Bus 125	12	45,3
Bus 115	12	23,4
Bus 121	12	30,6
Bus 122	12	42,6

Table 4 - Distance covered by cars and buses in Trastevere

The expected percentage variation in pollutants (CO, VOC, NOX, CO₂, PM) is shown in table 5 for S. Lorenzo district and in table 6 for Trastevere district. The *without* access restrictions scenarios are compared with second scenario (*with* traffic restriction and new electric buses) and with a third scenario (*with* traffic restriction and conventional buses).

As electric buses don't emit any pollutant, a decrease of 100% is reported in the second column for second scenario. In third column, a decrease of CO and VOC and an increase of NO_x, CO₂ and particulate were estimated.

	With electric buses	With conventional buses
CO	-100%	-49%
VOC	-100%	38%
NOX	-100%	442%
CO2	-100%	305%
PM	-100%	86%

Table 5 – Percentage variation of pollutant emissions in S. Lorenzo

	With electric buses	With conventional buses
CO	-100%	-70%
VOC	-100%	-19%
NOX	-100%	220%
CO2	-100%	139%
PM	-100%	10%

Table 6 – Percentage variation of pollutant emissions in Trastevere

b) The measure outcomes

The ex post assessments of the implementation of measure 7.3 was run according to its main goal, i.e. to extend the PT network supply within the Laboratory area; to this aim outcomes according to the most relevant evaluation categories have been studied and reported as follows; all results are synthesized at Table 1.

Environment

For both emissions and concentration surveys, even though observed that the main cause for the positive results in terms of pollution reduction are mostly due to access restriction measures. The use of LEV/ZEV further supports the good results in terms of pollutant concentrations. (refer to results in WP5)

Society

The qualitative relevance of both types of lines is confirmed by the appreciation showed by people. Awareness of the need to use clean transit increased from 53% to 76%, along with satisfaction which changed from 3.6 to 3.96 (1-5 Lickert scale), becoming the most "satisfactory measure" of the MIRACLES group. Another survey performed by Atac, to understand the users' perception and acceptance of the system, stressed that 86% of the interviewed people stated that they are in favour of the extension of the trolley line, because of the good performance of the line nr 90 in terms of:

- Environmental friendly operations;
- Low noise level;
- Quality service (punctuality, frequency, speed, capacity)

Transport

The trolleybus line substituted a connection, formerly operated by common buses, so in terms of supply, it was designed as an upgrading of the old service, transporting now about 2500 pass/h. Passenger numbers were, indeed, the most important indicator. Concerning the overall electric fleet (five lines), about 10,000 – 12,000 passengers are now recorded daily and about 32,000 for trolleybuses, successfully meeting the achievable target

MEASURE-LEVEL RESULTS

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of 200000 pax/month. For travel times, trips are now shorter, lasting about half the time, in average.

Economy

Also in this case, the theoretical cost per inhabitant for the infrastructure management seem to be very low, less than 1 Euro, confirming thus that the majority of the Miracles measures costs are below the 1 Euro/inh. threshold.

Measure 7.3: Introduction of new lines									
1	2	3	4	5	6	7	8	9	
MIRACLES number	MILETON number	Indicator (Units)	Base-year Value	Value	ITEMS Baseline Value	ITEMS Frozen Value	ITEMS Trend Value	Ex-post Value	Notes
R7.3/Econ.1.a		Cost for infrastructure (€/inhab)	0	0				0.9	No variations foreseen for frozen and trend scenarios
R7.3/Env.1.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080		1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R7.3/Env.1.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153		1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R7.3/Env.1.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697				1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R7.3/Env.2.a	5	concentrations of CO (millig/m ³)	1.77				No direct data available	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stat) (***)
R7.3/Env.2.b	6	concentrations of particulates (microg/m ³)	50.0				See table 2	44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (***)
R7.3/Env.2.c		concentrations of C6H6 (microg/m ³)	1) 8.75 2) 6.6					1)5.55 2)4.8	1) Measured value by monitoring network : mean of the yearly values of the stations inside the Lab area (3 stat) (***) 2) Measured value by passive samplers method (**)

Table 2 - Ex ante (with exception of the MIRACLES scenario) and ex post results (continues next page)

(**) Mean normalised value of all the 57 monitored locations. See specific document in Air Quality Report.

(***) The values of Villa Ada stations are not considered due to its use for the characterisation of the background air quality status of the city.

(****) Indicator useful only for a general assessment on the scenario.

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

Measure number: 7.3

City: Roma

Measure 7.3: Introduction of new lines								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R7.3/Soc.1.a	13	Awareness (%)	53				76	
R7.3/Soc.2.a		Satisfaction level (Lickert scale point 1 to 5)	3.60				3.96	
R7.3/Tras 1.a	18	Journey time (min)	0*				Lin – min** 90 - 40 115 - 31 116 - 22 117 - 30 119 - 16 141 - 13	* Not operating ** Single Journ
R7.3/Tras 1.b		Travelled people	0*				10000/12000 pax/day electric buses 32000 pax/day trolleybus	* Not operating About 670.000 pax/month in 2004

Table 2 - Ex ante (with exception of the MIRACLES scenario) and ex post results

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase by 25 km the electric network inside the Laboratory area	22,8 Km trolleybus line + 2 new electric bus lines which enlarge the electric bus network up to 52 km		☺☺☺
2) Increase the number of e-buses users by 200.000 pax/month at city level	About 670.000 pax/month		☺☺☺
3) Increase overall Customer Satisfaction Index (CSI) by 6%;	Public awareness of the need to use clean transit increased from 53% to 76%, and satisfaction increased from 3.6 to 3.96 (1-5 Lickert scale)..	This is the most “satisfactory measure” among the Rome MIRACLES measures	☺☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level ☺ difficult to assess ☺ not achieved</p>			

Upscaling - Status of the Measure beyond MIRACLES

The measure is currently operative and it will continue beyond MIRACLES, there are plans to increase the rate of clean vehicles and thus the trolley and electric bus lines.

MEASURE-LEVEL RESULTS

Measure title: Introduction of new lines

Project: MIRACLES

Measure number: 7.3

City: Roma

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The main difficulties occurred for LTZ extension in S.Lorenzo; the detailers claimed a decrease of business due to restricted access.

A short term measure showed that there is no bad consequence, while typically, after a short period of re-calibration by the users, the business increases about by 20%.

Anyway no particular barriers to the implementation of the electric bus lines, but the obviousness that if no buses are available the electric bus network could not be extended further; we refer to the problems encountered in the procurement of Electric buses, for details refer to WP 12.

One of the main barriers to the implementation of the trolley has concerned the discussions all the public bodies involved in the implementation of the line. In particular an agreement has been finally achieved with ACEA, the company which provides public lighting to the city, in order to use their poles also for the trolley plant.

Further the procedure for the execution of this kind of public works demands the involvement also of representatives of the citizens affected by the new implementations as well as with all the stakeholders, they are called in Italian “Conferenza dei Servizi”; this channel of communication which guarantees a high level of participation and of democracy may cause some delays.

M13: Interrelationships with other measures

This measure is linked to Work Package 5 “Access Restrictions” and to Work Package 12 “Clean vehicles” and to Work Package 6 “Parking Policies”.

M14: Lessons learned

1) The new **electric bus lines** have shown to be successful when implemented in a wider framework, in combination with measures that prevent the private traffic to access the “sensible” areas, and in the same time provide room for parking the cars.

The achievements obtained are very important and of particular relevance for larger European cities.

2) Concerning the **Trolley** we have learned that a solution exists to overcome the problem related to the “visual impact” of the aerial wire network, which would have definitely blocked the works, in an area subject to architectural obligations such as the City centre of Rome, the “Eternal City”.

The problem has been overcome by using vehicles that can run on batteries for a portion of the path. For more details refer to WP 12.

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12. Measure 7.4 - Integration of PT

MEASURE-LEVEL RESULTS	
Measure title: Improved Integration of PT	Project: Miracles
Measure number: 7.4	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
Main objectives of the measure for the introduction of a collective taxi (called “Taxibus”) were: <ul style="list-style-type: none"> ○ to increase the accessibility to the PT services; ○ to implement a collective taxi service, in an area of the city where the PT supply is poorer. 	
M2: Measure description:	
The measure was based on the implementation of a regular service of collective taxis from a northern district of Rome to downtown.	
The Taxibus service was sponsored and supported by the Municipality of Rome which gave to ATAC (its Agency for mobility) the responsibility for managing the Taxibus service; Atac was in charge to set a call for tender for the service, as well.	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
The Measure was aimed at improving the current service of Taxibus, and studying the possibility to design and to develop new lines serving different zones.	
The cars of the Taxibus service were equipped with bi-fuel engines, in order to run Diesel and CNG.	
M4: Situation before CIVITAS:	
Collective taxi services were initially operated without any planning, on a spontaneous basis. The service was then re-organised by STA prescribing minimum vehicles/service quality requirements for collective taxi operators. Three privately operated lines with high-quality service started operating soon afterwards. Indeed, Lines 1-2 and 3 started operating in 2000, and line 4 was implemented in 2003. All lines operated from 07.00 A.M. to 09.00 P.M.	
In figure 1 the situation before the Miracles project is shown and in table 1 main performances of the lines are reported.	
Figure 1 – Situation before the MIRACLES project	

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

Project: Miracles

Measure number: 7.4

City: Roma

N°	Route	Lenght (Km)	Journey time (min)	Frequency (passage/h)	Number of vehicles per line (N°)	Capacity (seats/day)
1	L.go di Vigna Stelluti- P.zza Aug. Imperatore	7,6	60	4	4	832
2	L.go di Vigna Stelluti- P.le Aldo Moro	8,1	60	3 - 4	3+1	600
3	P.zza Monteleone da Spoleto - P.zza Aug. Imperatore	7,5	60	3	3	624
4	via Sappada- Corso Francia (circolare)	9,7	45	4	3	864
TOTAL		32,9	-	-	14	2920

Table 1 – Main performances of lines implemented before the MIRACLES project

M5: Design of the measure:

The design of the measure was based on the analysis of the existing situation and on the implementation of new lines, according to the following steps:

- Analysis of the satisfaction level among the Taxibus users, according to a customer satisfaction survey run by the operator;
- Specification and issue of the first call for tender
- Promotion of the Taxibus existing lines;
- Studies and implementation of two new lines: (1) Corso Francia - Vigna Stelluti, operational by September 2002; (2) Via Cassia (Villaggio dei Cronisti), Corso Francia, operational by September 2003. Both lines operated with a frequency of 15';
- Study and analysis of the user acceptance of different payment possibilities (single ticket, subscription ticket), as an outcome from the customer satisfaction survey;
- design to enhance and develop new Taxibus lines serving different zones nearby/to the city centre;
- Full implementation of the new lines.

M6: Actual implementation:

Peopleservice was the first company to gain the tender to operate the service, according to the first contract with the Municipality, for the period 2002 – 2004. Peopleservice successfully operated the first set of 4 lines, since then. Routes were partly located on the Northern limit of the Laboratory Area -Viale Mazzini, Piazza Mazzini, Viale Lepanto, Piazza Cola di Rienzo.

According to the City Council assignment in 2004, Atac S.p.A. fixed a new call for tender for the period 2005 – 2007.

On 31st December 2004 the contract with Peopleservice expired; Atac S.p.A and Rome Municipality transport agency assigned for a three years period the service in the North-west side of the city to a new company, which started operating with eight new lines, after a first study on eleven new routes.

The 8 lines link the following sites (see figure 2):

- 1: via Sappada – Corso Francia
- 2: via Monteleone da Spoleto – P.zza Augusto Imperatore
- 3: L.go di Vigna Stelluti – P.le Aldo Moro
- 4: P.le Aldo Moro – P.zza augusto Imperatore
- 5: L.go di Vigna Stelluti – P.zza Augusto Imperatore
- 6: L.go di Vigna Stelluti – via Grottarossa
- 7: Via Monteleone da Spoleto - P.le Aldo Moro
- 8: Cassia Due ponti

The lines were operative from Mondays to Saturdays from 7.00 to 21.00. The frequency was every 15 minutes in peak hours and every 20 minutes in off-peak hours, with 28 EURO IV bi fuel vehicles

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

Project: Miracles

Measure number: 7.4

City: Roma

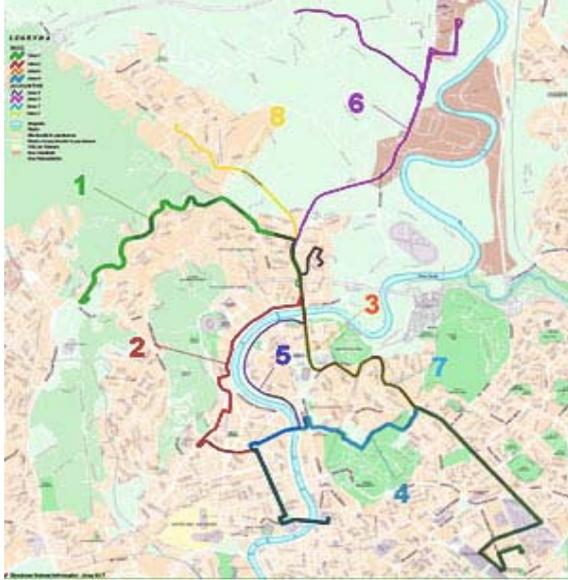


Figure 2 - The 8 new Taxibus lines

Prices have been identified for each line, according to the following:

INTEGRATIVE SERVICES - SUBSCRIPTION: PRICES <i>(workers-students-childrens)</i>			INTEGRATIVE SERVICE: PRICES PER TRIP		
	10 trips	20 trips		Euro	<i>Discounted price from 10.00 to 17.00</i>
LINE 1	23,00 €	44,00 €	LINE 1	3,00 €	2,00 €
LINE 2	28,00 €	52,00 €	LINE 2	6,00 €	3,00 €
LINE 3	28,00 €	52,00 €	LINE 3	6,00 €	3,00 €
LINE 4	28,00 €	52,00 €	LINE 4	6,00 €	3,00 €
LINE 5	28,00 €	52,00 €	LINE 5	6,00 €	3,00 €
LINE 6	25,00 €	48,00 €	LINE 6	5,00 €	3,00 €
LINE 7	28,00 €	52,00 €	LINE 7	6,00 €	3,00 €
LINE 8	23,00 €	44,00 €	LINE 8	3,00 €	2,00 €

M7: Deviations from the plan:

It was planned to implement eleven new lines; currently only eight of them have, this was due to a revised and more efficient use of the Taxibus network. (See also M6).

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable. For measures 7.4 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: not relevant because the service operates on existing transit infrastructure

Evaluation category: *Energy*

- *Energy efficiency per transport mode*: added, due to the ITEMS application

- *Vehicle fuel efficiency*: added, due to the ITEMS application

Evaluation category: *Transport*

- *Modal split*: not relevant, being esteemed as 0,004% of the transit share

- *Average delays/waiting time*: removed because not estimated

- *Number of intermodal change points*: not relevant, because the service operates on existing transit facilities

MEASURE-LEVEL RESULTS	
Measure title: Improved Integration of PT	Project: Miracles
Measure number: 7.4	City: Roma
<i>The Evaluation – how was it done and what are the results?</i>	
M8: Method of measurement:	
The tools and the data sources used to esteem and measure the values of the indicators for collective taxis were manifold.	
<u>Energy Indicators</u>	
The Energy indicator “Vehicle fuel efficiency” was elaborated in baseline, frozen and trend scenarios from ITEMS results for private car, whereas the indicator “Energy efficiency of transport modes” was calculated from ITEMS results and from data provided by DITS concerning Taxibus average occupancy. For the latter, DITS elaborated the do-something value, as well. Ex post values were provided by ATAC.	
<u>Economy Indicators</u>	
The Economy indicator “System operating cost” was elaborated from DITS database only for the 2001 value and it was not possible to esteem this value in trend and frozen scenarios, for the do-nothing study. The Miracles scenario value was provided by a DITS study and eventually the ex post value was provided by ATAC.	
<u>Society Indicators</u>	
Society indicators concerned satisfaction level, awareness, expectations towards involved bodies and use motivation; they were not available for the ex ante phase. Indeed, the customer survey run by the 2001 operator provided some general interesting findings, as results of vis-à-vis questionnaires; this customer satisfaction survey, undertaken at the early stage of implementation, helped to identify user needs and possible new trends for the operations, as well as the “willingness to pay”. Such findings were useful to plan the service extension, which was based mainly on the core objective of increasing the frequency of existing lines. However, such results were not directly transferable for the MIRACLES extents, and this can explain why for all society indicators no quantitative data were available for baseline, frozen and trend scenarios.	
For what concerns the ex post values, Society indicators on Awareness, Use motivation and Expectations towards involved agencies/bodies were estimated by DIPPSI with phone interviews to 1.400 subjects, over 14 years old, resident in Rome and defined a Cultural Mapping of roman population, whereas satisfaction level was estimated both with phone interviews and with focus groups : (10 groups formed of 8-10 subjects, each; 90 minutes each)	
For what concerns data from phone interviews, interviewees’ texts were processed by AET (Emotional Text Analysis), enable to outline the local culture typical of a particular social context.	
<u>Transport Indicators</u>	
Transport indicators were referred to changes of the public transport service. They were trips/day, new routes, total amount of Km produced/day, journey time (min), average speed and travelled people.	
Baseline values referred to year 2001 were provided by operators and Rome Municipality. Only for “Travelled people” the esteemed value for the trend scenario was assessed by supposing a variation of customers proportional to the variation of Rome population.	
In the do-something scenario values of transport indicators were esteemed by DITS.	
Ex post values were provided by the ATAC database.	
M9: Achievement of quantifiable targets:	
According to the initial plans, a first group of 3 lines has been implemented and evaluated, then a new tendering process has been carried out to enlarge the service.	
At the end 8 lines were implemented, as part of the set of measures integrated in the mobility system of Rome, so to increase supply and use of flexible collective transport services/Taxibus lines.	
The quantifiable target was to increase the collective vehicles occupancy by 20%; Collective taxis occupancy was about 35 % (baseline 30%) for most of the implementation period.	
Another remarkable result concerns the Society aspects (table 3), all the 3 indicators Acceptance, Satisfaction and Awareness provide good outcomes.	
M10: Achievement of evaluation-related milestones:	
All the evaluation related milestones were achieved according to the implementation process and evaluation schedule.	
M11: Report on the measure results:	

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

Project: Miracles

Measure number: 7.4

City: Roma

Results reported in this paragraph are divided into the following sub-sections:

- a) Outcomes coming from the do something scenario, also called Miracles Scenario
- b) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- c) A comparison between quantifiable objectives and actual achieved results

a) The Miracles Scenario

The simulation process

The simulation concerned the hypothesis to add new four lines to the four already operating ones. to the four already operating

The service extension was designed according to two main objectives; existing lines' frequencies were increased and spatial, temporal and operating flexibility should be enhanced. For instance, an improvement of the booking system (via phone, sms or web) would allow small route diversions to reduce ancillary walking to Taxibus stops for elderly and impaired people (all vehicles are fully accessible by wheelchair).

Concerning the four new lines, having designed the new routes on the map, the next step was to define an operating plan, to assess the service performance for a period of three years. Moreover, some crucial features stated in the study of the already operating lines, such as the need for higher frequency and spatial flexibility had to be taken into account.

The operating plan differs from year to year, in terms of supplied service, increasing until the third year, when the potential demand is fully met. It was not realistic to expect demand to reach target levels in a shorter period, due to the long time needed to attract new customers for a service, and given the consideration that, in some areas, this service was absolutely innovative and virtually unknown.

To calculate the potential daily demand, rough evaluations have been used to quantify traffic flows on the basis of the 1991 National Census data. To this end, among the total daily flows for work and school trips in the whole Roman area, only trips by private cars (about 61% of all trips) have been considered. The data have been updated to 2001 and it has been assumed a peak hour flow as about 12 % of the total daily demand. Finally, only the flows related to the area of implementation have been considered. The quantification of the attractable customers demand has been run calculating just the amount of the disposed-to-pay-more-than-bus customers. The decision to take into consideration only private cars users as potential patrons relies mainly on social and environmental reasons: for the former the big amount of private cars shifts (that could be switched towards a faster and more reliable service than Public Transport), for the latter the high level of pollution caused by private cars.

The simulation result

Table 2 synthesizes transport indicator values, since they changed from line to line, in the do-something scenario. If Table 1 results (baseline) are compared to those of Table 2, some relevant aspects can be stressed in terms of improved performances. The network length more than doubles passing from 33 km to 72 km; even though journey times remain unchanged, the frequency increases. Passengers increased from about 385000 units/year (see Table 2, indicator "travelled people") to about 1156000, a value which can be competitive to the traditional transit service, still keeping in mind the "niche" feature of the collective taxis. Such increased values affect another key-parameter: the occupancy (pass km/seats km), which according to this forecast should switch from 30% (baseline) up to 37%.

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

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N°	Route	length [km]	Commercial speed[km/h]	Journey time [min]	Travelled people [pass/day]	Travelled people [pass/year]	Frequency peak hour [Passage/h]	Frequency no peak hour[Passage/h]	Trips per day [no per day]	total amount of km [km per day]
1	Via Sappada Cso Francia	9,7	12,9	45	652	195600	10	6	100	970
2	P.zza Monteleone di Spoleto P.zza Aug. Imperatore	8,1	13,0	47	212	63600	4	2	36	291,6
3	L.go di Vigna Stelluti P.zza Aug. Imperatore	7,6	15,2	60	397	119100	6	4	64	486,4
4	L.go di Vigna Stelluti P.le Aldo Moro	8,1	16,2	60	492	147600	8	5	82	664,2
5	P.zza Monteleone di Spoleto P.le Aldo Moro	10	13,0	56	249	74700	4	3	46	460
6	Cassia (Due Ponti) Cso Francia	7,6	13,0	45	637	191100	10	6	100	760
7	L.go di Vigna Stelluti via di Grottarossa	10,80	13,0	60	717	215100	11	7	114	1231,2
8	Ple Aldo Moro P.zza Aug. Imperatore	10,5	13,0	58	497	149100	8	5	82	861
TOTAL		72			3853	1155900			624	5724

Service operating for 14 hours day for 300 days year (4 Peak hours service considered)

Table 2 - Do-something results (Miracles Scenario) for each line

b) The measure outcomes

This section describes main results achieved by Miracles Measure 7.4 “Improved integration of PT”.

The indicators for ex ante/ex post evaluations of this measure were divided in four sections: an Economy (costs for operating), Energy, Society and Transport indicators, as already stressed in section M8 and according to evaluation categories and indicators and to the measure’s general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex

An overview of values of indicators in baseline, frozen, trend and do-something scenarios is reported in Table 3.

Economy

The economy indicator showed an increasing cost of service from 0,9 euro/inh to 1,28 euro/inh, in the Miracles scenario. This fact was due to the strong improvement of service that for the **baseline** was used by about 190.000 pax/year for a total amount of 2.270 km/day; in **do-something** scenario the service was assessed to be used by more than 1 million people per year for a total amount of 5.724 km/day.

Such cost was not confirmed by the ex post data, which on the contrary stressed that costs for operating noticeably decreased.

Energy

Energy indicators did not show variations from baseline to frozen scenarios. In trend and in do-something scenarios it was possible to observe a drop for “Energy efficiency of transport modes”; this reduction in the do-something scenario was quite strong and the value of the indicator was 0,32 MJ/pers*km.

Society

For society indicators ex-post values of Acceptance, Satisfaction level and Awareness provided by DIPPSI are reported. Both good appreciations of the service and a strong awareness of the need to implement this kind of measures were the main findings.

Transport

Transport indicators showed a strong improvement of service in terms of trip day, total amount of km in a day and new route, thus meeting the measure main objective: to increase supply and use of flexible collective transport services/Taxibus lines

No comparison was possible between data on average speed of year 2001 and do-something scenario similar data because, in the latter case, there were more lines operating. Anyway in this scenario, values of average speed for different lines were among 13 and 16 Km/hour. Same considerations were valid for journey time (see Tables 3 and 2).

In general, ex post data positively confirmed transport trends developed for the Miracles scenario, and values were in general higher than the scenario ones, because one extra line was implemented. Such trend was confirmed till the last months of implementation of the service.

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

Project: Miracles

Measure number: 7.4

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Summary WP 7.4 Improved integration of PT							
Indicator (units)		Baseline	Do-nothing (2006)		Miracles Scenario	Ex post value	
			Frozen	Trend			
R7.4/Econ.1.a	Cost for operating (Euro/inh)	0,9	No	No	1,28*	0,60 (16,48 Euro/user)	Do- something population value supposed similar to the one in trend scenario
R7.4/Ener.1.a	Energy efficiency of transport modes (MJ/pkm)	0,46	0,46	0,42	0,32*	0,000376 (liter/pkm) 1,16 10 ⁻³ (MJ/pkm)	
R7.4/Ener.1.b	Vehicle fuel efficiency (MJ/veh-km)	1,1	1,1	1	N/A	0,0055 (liter/veh-km) 0,17 (MJ/veh-km)	
R7.4/Soc.1.b	Satisfaction level (lickert scale point 1 to 5)	N/A	N/A	N/A	N/A	3,13	
R7.4/Soc.1.a	Awareness (%)	N/A	N/A	N/A	N/A	49 %	
R7.4/Soc.2.a	Acceptance (lickert scale point 1 to 5)					3,13 3.19 cluster1 3.27 cluster2 2.78 cluster3 3.00 cluster4 3.06 cluster5	(Likert 1-5) Acceptance = how the satisfaction score takes part of the different clusters of the local culture
R7.4/Soc.3.a	Expectations towards involved agencies/bodies					Administration invests in satisfaction for the citizen: - 75,6; +24,39; Administration invests in services: - 40,99; + 59,01; Administration invests in production activities: - 7,66; + 92,34; Administration invests cultural heritage -13,55; +86,45	% - = low + =high
R7.4/Soc.3.b	Use motivation					49% population. 56% cluster1 48% cluster2 43% cluster3 54% cluster4 51% cluster5	

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT Measure number: 7.4					Project: Miracles City: Roma		
R7.4/Tran.3.a	Trips (no per day.)	160	No	No	624	752	For information on single line see table 4 (do-something)
R7.4/Tran.3.b	new routes (no.)	1	No	No	7	8	
R7.4/Tran.3.c	total amount of km (km per day)	2270	No	No	5724	5989	For information on single lines see table 4 (do-something)
R7.4/Tran.3.d	Journey time (min)	60	No	No	see table 4	20	
R7.4/Tran.3.e	average speed (km/h)	15	No	No	see table 4	15,27	
R7.4/Tran.3.f	travelled people (no.)	(31/12/2001) 192.591 line1 88900 line2 53800 line3 50500		192.535 Line1 88594 line2 53615 line3 50326	115575	410 people/day	For information on single lines see table 4 (do-something)

Table 3 - Ex ante – ex post evaluation data

Notes:

cluster 1= control, cluster 2= confidence, cluster 3= anarchy, cluster 4= efficiency, cluster 5= mistrust; N/A = data not available

*Data run by DITS

No = no variation foreseen

All do-something data are referred to 2006

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase collective vehicles occupancy by 20%	Collective taxis occupancy was about 35 % (baseline 30%) for most of the implementation period; in the last months it decreased to 15%	<i>Too short period of surveys to formulate sound interpretations of the phenomenon.</i>	☹
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Upscaling – Status of the measure beyond Miracles

Upscaling possibilities should be high at city level, being neither regulatory nor infrastructural hindrances to the implementation of collective transportation lines. It is difficult, however, to assess which could be possible benefits in terms of environment and traffic, since they could be appreciated only by a city wide implementation and in accordance to the development of a general sustainable mobility based governance of transit. If no integration would be possible between collective taxis and buses in terms of operation management and energy consumption, such measure could negatively affect the mobility situation, resulting collective taxis just as more circulating vehicles in the city.

MEASURE-LEVEL RESULTS

Measure title: Improved Integration of PT

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Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

It is undeniable that “collective taxis” was a successful measure, implemented in a context with lower PT supply, providing a good option for home-to-work or to downtown shifts, at reasonable prices, with comfortable travel however still there is some experience to do in order to get to very positive and effective results. The four/five years experience gained so far has pointed out several issues to be highlighted:

1. Factors that could negatively influence any further implementation relied mainly on the long time needed for call for tender procedures when new lines are required;
2. The vehicles used to exploit the Taxibus service could run both on CNG and on diesel. Due to the lack of CNG recharging stations, they have mainly run on diesel.
3. the fulfilment of bureaucratic and administrative tasks could turn to be a hindrance in terms of time needed to the implementation;
4. the cost of the tickets for the service is higher than the ordinary one indeed, for fare higher than 3 Euro for a single trip, customers said would not opt for the service anymore
5. Still is **not integrated** in the “metrebus” system, which allows to take advantage of all the PT services with one ticket. Further, each line has a different ticket and different prices.

M13: Interrelationships with other measures

The measure is related to 5.1 clean zones and 6.1 pricing.

M14: Lessons learned

A measure as Taxibus can be adopted in any other city where PT supply is perceived by users as not good in terms of comfort and reliability; indeed, it represents a kind of “business class” for bus/metro users who are disposed to pay a little more (but less than taxi) just to arrive in time, close to their destinations and in a comfortable way, especially in hard weather conditions.

Actually, not bad lessons can be learned from this measure; it must be considered, however, that this kind of service could be just less attractive in case of already-operative high quality PT system.

A good lesson could be represented by the possibility provided by Taxibus to increase flexibility (both in terms of routes and in terms of timetable) to the whole PT system, thanks to the opportunity to operate on special routes, on special schedules, and to divert from them on given days and on given hours.

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13. Measure 8.1.1 - Car Pooling

MEASURE-LEVEL RESULTS	
Measure title: New forms of vehicle use – Car Pooling	Project: Miracles
Measure number: 8.1.1	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Original objectives were referred in general to both the measures 8.1 and 8.2 and were:</p> <ul style="list-style-type: none"> • To provide new forms of vehicle use • To promote car sharing and car pooling. <p>Concerning the instrumental objectives to pursue car pooling these were:</p> <ul style="list-style-type: none"> ○ Increase awareness on the opportunities of taking advantage of car pooling; ○ Experiment car pooling with a group of some 1000 employees; ○ Understand if and how car pooling can be implemented. 	
M2: Measure description:	
<p>Car-pooling is a measure dedicated mainly to commuters; it consists in encouraging the employees of a company to reach the workplace by sharing the same car.</p> <p>The initiative in Rome has involved all the employees of the Municipality offices, the Polyclinic, the University. The Municipality has also been project manager and sponsor of the measure.</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>A specific software has been developed called SITICAR, to support the service, through the following functions:</p> <ul style="list-style-type: none"> • Manage registrations and applications; • Manage trip requests; • Set up commuters crews; • Display routes; • Manage emergencies; • Manage communications; • Produce invoices; • Provide help on line. 	
M4: Situation before CIVITAS:	
<p>Rome has a very high number of commuters. During peak hours many cars carry only one passenger. Some car pooling crews already existed in companies, but in a disjointed and spontaneous form: it was necessary a new approach, based on systematic issues, in order to achieve a scheduled system for the collective use the car.</p>	
M5: Design of the measure:	
<p>A wide surveys campaign has been completed at the outset by STA on the whole urban area in order to analyse the systematic mobility in the Laboratory Area. For this purpose more than 100.000 interviews have been processed. A simulation model has been integrated and installed in the Sustainable Mobility Department, integrated in the Mobility Manager System, to manage the car pooling service in the laboratory area. The Model based on the origin and destination of users, takes in consideration some revealed preferences about the trip characteristics and time scheduling.</p> <p>According to the indications received by the City Council ATAC has set up a front office to provide support to the mobility managers who want to promote car pooling amongst their colleagues.</p> <p>In particular ATAC provides legal and technical expertise technical support through computer-based tools, which allow analysis of the different needs of companies and persons involved and help the creation of the HWTP.</p>	
M6: Actual implementation:	
<p>The car pooling experiment has been developed, by addressing a group of about 1.000 employees both of the Policlinico (the principal hospital in Rome) and of the Municipality office.</p> <p>With the support of the SITICAR software the Commuters' Plans have been designed:</p> <p>As it concerns the Municipality offices, a group of 480 employees have been involved and 160 crews have been</p>	

MEASURE-LEVEL RESULTS	
Measure title: New forms of vehicle use – Car Pooling	Project: Miracles
Measure number: 8.1.1	City: Roma
<p>formed.</p> <p>Concerning the Policlinic, 600 employees have joined the experiment and 200 crews have been formed. An extra commuters' plan has been studied also for the Ministry of Public Health and submitted to its Mobility Manager (100 employees, 23 crews created)</p> <p>The car pooling service, after this first experimental phase, has shown to have a problem compared to the car sharing: a very high level of control is requested, since it has been pointed out that for example there was an improper use of the parking stalls reserved to car-poolers.</p> <p>After the experimentation the City Council has issued a "Delibera" n°14/05, in which, according to the results obtained, it has decided to adopt a better defined "policy" to award eligibility to car pooling projects submitted, they will be selected only:</p> <ul style="list-style-type: none"> • Firms with private parking areas allowing the final destination of some stalls for car-poolers; • Firms having special conventions with private garages; • Firms having spontaneous carpooling practices already activated; • Firms and car-poolers will have to release a declaration to adhere to the activities for at least one year. <p>Incentives will be provided in terms of free PT passes for the employees and provision of free of charge software to set up the crews.</p>	
M7: Deviations from the plan:	
<p>No major deviations for the implementation phase</p> <p>Indicators – Deviation from what planned in deliverable 4.1</p> <p>See measure 8.1.2 template, section M7</p>	
The Evaluation – how was it done and what are the results?	
M8: Method of measurement:	
<p>Because of the many indicators, several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.</p> <p>Transport Indicators</p> <p>The implementers (STA And ATAC) provided information on the service. Most of quantitative information have been obtained by existing database, which were continuously updated to collect data available for the ex post phase.</p> <p>Other indicators</p> <p>No data useful to describe directly the baseline situation of the energy indicators (efficiency of transport modes and Vehicle fuel efficiency) was available, but that one elaborated thanks to the ITEMS exercise.</p>	
M9: Achievement of quantifiable targets:	
<p>The target of addressing and testing the service to a sample of 1.000 people has been achieved.</p>	
M10: Achievement of evaluation-related milestones:	
<p>All the evaluation related milestones were achieved according to the implementation process and evaluation schedule.</p>	
M11: Report on the measure results:	
<p>Results reported in this paragraph are divided into the following sub-sections:</p> <ol style="list-style-type: none"> a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex b) A comparison between quantifiable objectives and actual achieved results <p>a) The measure outcomes</p> <p>The measure goal was to provide new forms of vehicles use, by the promotion of car pooling. Impacts in terms of transport changes and energy consumption were analysed, stressing also the contribution that car pooling has in the improvement of the air quality levels. All results are synthesized in Table 1.</p> <p>Transport</p> <p>For the whole ex ante phase not relevant changes were neither surveyed for the baseline nor simulated for the scenario, with exception of modal split that for the do-nothing scenarios slowly increased in favour of non motorized modes. Most relevant change concerned the number of travelled people which passes from 750 participants (baseline) to 1180 (ex post), and the number of consolidated crews, about 360; such values determine a very high occupancy rate, about 75%.</p> <p>Energy</p> <p>Given the lack of available baseline data for the energy consumption assessment, ITEMS and the do-something scenarios provided not relevant forecasts; the ex post measurement confirmed the "niche" status of the measure also in terms of fuel consumption and energy efficiency.</p>	

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Pooling

Project: Miracles

Measure number: 8.1.1

City: Roma

Environment

As stressed in WP5 templates, the good result in terms of concentrations and emissions reductions was obtained as a general effect of all the measures adopted in Miracles project (for method of measurements see M8 section at WP5 templates); in particular, the role of car pooling, among the “niche” measures is one of the most important. Hence in table 1 it is worth to report air quality values.

Summary WP 8.1.1 New forms of vehicle use – car pooling

Indicator (units)	Baseline	Do-nothing (2006)		Miracles scenario	Ex-post	Note
		Frozen	Trend			
R8.1/Ener.1.a Energy efficiency of transport modes (MJ/pkm)		0,36	0,36	0,33	1,9 x10 ⁻⁴ MJ/pkm	
R8.1/Ener.1.b Vehicle fuel efficiency (MJ/veh-km)		1,1	1,1	1,0	0.028 MJ/veh-km	
R8.1/Env.1.a emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R8.1/Env.1.b emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1)21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R8.1/Env.1.c emissions of C6H6 (kg/h and kg/day)	1)96 2)697	N/A	N/A	1)48,5 2)349,5	1)60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday
R8.1/Env.2.a concentrations of CO (millig/m ³)	1)77	N/A	N/A	N/A	1.4	
R8.1/Env.2.b concentrations of particulates (microg/m ³)	1)50.0	N/A	N/A	N/A	44.4	
R8.1/Env.2.c concentrations of C6H6 (microg/m ³)	1)8.75 2)6.6	N/A	N/A	N/A	1) 5.55 2) 4.8	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (3) 2) Measured value by passive samplers method
R8.1/Tran.1.a modal split (motorized and non-motorized) (% of the total flow)	1)20 a)48 b)11 c)21 2) a)30 b)27 c)23 d)20	1) a) 22 b)+c)53 d) 25	1) whole city 2) Rail Ring Area a) PT b) Priv 4-wheels c) Priv 2-wheels d) Walking a) 31 b) 22 c) 24 d) 23			
R8.1/Tran.1.b traffic levels (trips day per vehicle)	2,2	2,5	2,5	N/A	2.5	
R8.1/Tran.1.c trips (millions no.)	1)5,6 2)1,42	1)4.8* 2)1,53 **	1)4,9* 2)1,55**	N/A	0,000150	1)whole city 2)Rail Ring Area
R8.1/Tran.1.d travelled people (no.)	750	No	No	N/A	1180	

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Pooling

Project: Miracles

Measure number: 8.1.1

City: Roma

N/A= data not available; No= no variation foreseen; T.B.C.= To Be Completed

* Data provided by local partners; ** ITEMS Data or elaborated from ITEMS Results

Table 1: ex-ante and ex-post measure indicators

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase collective vehicles occupancy by 20%	Occupancy rate of vehicles during the trial: 75%	The large scale implementation of this measure consists in the control and verification on the proper use of parking areas that are free for car poolers.	😊😊😊
2) Broaden up to 1,000 citizens the car pooling group in the Demonstration Area	Car-poolers addressed during the trial have been 1180		😊😊😊

Caption

😊😊😊 achieved far beyond forecasts; 😊😊 not fully achieved but still satisfactory outcome; 😊 achieved at a minor level
 😊 difficult to assess 😊 not achieved

Status of the Measure beyond MIRACLES

The measure is currently operative and will continue beyond MIRACLES after a re-modulation of the assignment of the car pooling funding (ref to lessons learned)

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The car pooling service, after this first experimental phase, has shown to have a problem compared to the car sharing: a very high level of control is requested, since it has been pointed out that for example there was an improper use of the parking stalls reserved to car-poolers.

M13: Interrelationships with other measures

The measure is strictly related to the Car Sharing and Mobility Management measure.

M14: Lessons learned

The Municipality has learned that incentives on car pooling will be issued **only** to support :

- Co-financing of the expenses of private garages;
- Free annual inscription to the car sharing service;
- Free season pass for urban public transport (METREBUS card);
- Utilization of a user friendly software free of charge to support the activities for carpooling in firms.

Contact person: Mr Alberto Bernagozzi - ATAC SpA – email alberto.bernagozzi@atac.roma.it

14. Measure 8.1.2 – Car Sharing

MEASURE-LEVEL RESULTS	
Measure title: New forms of vehicle use – Car Sharing	Project: Miracles
Measure number: 8.1.2	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Original objectives were referred in general to both the measures 8.1 and 8.2 and were:</p> <ul style="list-style-type: none"> • To provide new forms of vehicle use • To promote car sharing and car pooling. <p>The car sharing has been pursued through the following objective: to contribute to change current transportation habits by implementing the first car sharing scheme in Rome, thereby creating an alternative to the purchase of a private car and indirectly enhancing the use of PT service.</p>	
M2: Measure description:	
<p>The main aim of the Roma Car Sharing service is to discourage the purchase of the second, third car per family offering an integrative service to the Public Transport. In particular, in Rome many people use the private car less than 10.000 km per year, in some case paying high costs for garage, insurance and maintenance: the car sharing is a right solution to save money and set free parking lots.</p> <p>Thanks to a deliberation of the Town Council of the City of Rome (n. 1023/22.12.04) an experimental test of car sharing started on 07.03.05 in a laboratory Area identified by a sole District (Municipio Roma III) containing the larger general hospital (Policlinico Umberto I), the first University of Rome (La Sapienza) and embracing the two main Railway Stations of Rome (Termini and Tiburtina).</p> <p>The service has been initially dimensioned for a user group of 200 people, 10 cars of different sizes are available. After one month from the start up of the service ATAC has been constantly monitoring the performances.</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>Roma Car Sharing is one of the eight services operating in Italy under the Iniziativa Car Sharing (ICS) Association. The other services are in Bologna, Turin, Venice, Genoa, Florence, Modena and Rimini. The interoperability system allows the user of Rome to use the service in the other city by means a sole smart card and vice versa.</p>	
M4: Situation before CIVITAS:	
<p>No car sharing service was previously available in Rome.</p>	
M5: Design of the measure:	
<p>The measure was designed according to the following steps:</p> <ol style="list-style-type: none"> 1)Pre-feasibility Study : analysis of the potential demand and of the available supply, in terms of equipment, organization models, vehicles etc; 2)Team project Set-up: ATAC carried out the project with some industrial/technological partners to be involved in specific work on the “attractors point” of the Laboratory area; 3)Project design: The partners defined all the specifics of the project to carry out an operative work plan; (TRS as the technological provider FIAT Savarent as the provider of ten cars Legambiente as the service manager) 4)Test phase: start-up of the experimental phase of the service. A managing framework was implemented once consolidated results were achieved; 5)Awareness measures: at the start-up of the experimental service a promotional campaign was carried out to supply citizens with information regarding this new initiative and to encourage project support; and the TP pass-holders of 3rd District were contacted by mail and offered a discount to subscribe to the new car sharing service. 6)Analysis and results: analysis of the customer satisfaction and calibration of the initial plan according to the service results. 7) Identification of the area for test - the 3rd District (Municipio Roma III) has been chosen for the experiment (containing the larger general hospital, the first University of Rome (La Sapienza) and embracing the two main Railway Stations of Rome). 	

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

M6: Actual implementation:

Car Sharing has been launched on the 9th of March 2005, for an experimental phase of 1 year.

The main features are:

- Car Sharing is reserved to subscribers only
- Operating 24 hours to 24
- The reservation is possible via internet or national call centre only to the phone number 848-787787,
- The minimum time use is 1 hour and the maximum time is up to 4 days
- An information call centre 800-201670 has been activated by ATAC to provide information about the service, the parking lots and how to subscribe to the service, the call centre also provides assistance in case of emergencies such as vehicle breakdown

The car sharing fleet is allowed to:

- Free parking in fare zones and in parking located in intermodal nodes;
- access for free in the Limited Traffic Zone of Rome;
- access and circulate in preferential lanes for the Public Transport, as the same rules of taxi service;
- circulate during the “car free cities”

Different types of cars are available in the reserved garages and parks, located in 5 parking lots. These cars are all equipped with ABS system and Air conditioning and personalized in yellow color, three cars are GPN fuelled while the remaining cars are gasoline fuelled.

(On the 7th of March 2006 the first experimental phase has been concluded. The actual subscribers and the citizens that provided the joining demand want to know how the service will evolve.)



Figure 1: one of the vehicles

Functioning of the system:

The reserved car is made available by inserting a smart card in a reader located in the dashboard of the car, and then repeating the procedure at the end of the journey. The data for monitoring the service and calculating the cost of the trip (such as departure and returning time, distance in kilometres, duration of the use) is automatically registered. In addition to a yearly subscription, the user pays for the car in accordance to the covered kilometers and to the duration of the use.

It is mandatory to leave the card at the end of the run in the same parking (in other words it is not possible to have one-way service).

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma



Figure 2: The Logo of the service and an example of use by a customer

Car sharing vehicles are allowed to park free of charge in every car park of the city, including the park & ride zones. They can enter the LTZ (Limited Traffic Zone) and the preferential lanes; they are also allowed to circulate in the interdict zones during the limited traffic days.



Figure 3: a car sharing parking area

M7: Deviations from the plan:

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable. For both measures 8.1.1 and 8.1.2 deviations occurred to the following indicators:

Evaluation category: Economy

- *Cost for changes of infrastructure per inh and Cost for maintenance*: included in costs for operating

Evaluation category: Energy

- *Energy efficiency per transport mode*: added, due to the ITEMS application

- *Vehicle fuel efficiency*: added, due to the ITEMS application

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

Evaluation category: *Environment*

- *Noise level*: removed because not reliable data contributed to create a sample that could determine the noise contribution provided by such collective modes. Such value however becomes not relevant given the very low number of vehicles involved in the measures, which could contribute locally to a noise reduction not even monitorable by a photometer in usual condition of traffic flows, due to the white noise high level.

- *Emissions of NOx*: substituted with C₆H₆ emissions because more relevant

- *Concentrations of NOx*: substituted with C₆H₆ concentrations because more relevant

Evaluation category: *Society*

- *Operators acceptance*: removed because the operators did not provide a relevant number of replies to build a consistent sample

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Because of the many indicators, several methods of measurements were applied, taking care to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.

Economy indicators

ATAC, the implementer, provided information on the service economic facets. Most of quantitative information have been obtained by existing database, which were continuously updated to collect data available for the ex post phase. In particular, costs for operating include the costs of the Call Centre and also cost for maintenance (fuel, leasing, etc.) and costs for changes the infrastructure (indoor parking);

Transport Indicators

ATAC provided information on the service.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertories (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Other indicators

For the energy indicators, although there was no data directly available to measure the baseline situation, estimates were made using the ITEMS model.

M9: Achievement of quantifiable targets:

Up to now after seventeen months 290 subscribers have been registered and more that 860 joining demands to the service have been submitted to ATAC.

Most of the joining applications come from undecided people form other districts of Rome that would like to use the service with parking lots closer to their places.

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; in particular current amount of users is aimed at finalizing the car sharing trial for the achievement of minimal standards for a quality service.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

The measure goal was to provide new forms of vehicles use, by the promotion of car sharing along with car pooling. Impacts in terms of transport changes, society and energy consumption, stressing also the contribution that car pooling has in the improvement of the air quality levels. All results are synthesized in Table 1.

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

Economy

Both indicators, respectively cost for operating and income, are based on modest quantities reflecting the “niche” feature of the service till now. In particular the theoretical cost for operating per inh. is one of the lowest of the MIRACLES measures

Environment

The results, here reported, represent an evaluation of a general effect of all the Miracles measures that have direct impact on air pollution. Being car sharing a “niche” measure, it is, however, worth reporting both ex ante and ex post results at city level because the implementation of this new form of vehicles use contributed to such improvements.

Society

Car-sharing is not well known and a problem of this measure is that the car is often regarded as a place of intimacy and solitude and not to be shared with other people. This can explain the small index of awareness (14%) among the ex post sample of interviewees. On the contrary the value of “Satisfaction level” is quite high.

Transport

Indicators measured for the ex ante and baseline phases concerned modal split, traffic levels, trips and travelled people; all measured values stress the “niche” character of the measure. For example, for what concerns the modal split, the value strictly concerning car sharing is assumed as a share of the transit percentage.

Anyway some late statistics have been provided by ATAC that is the manager of the service.

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

MAIN STATISTICS - FROM MARCH 2005 TO JUNE 2006



	Mar.05	Apr.05	May05	Jun.05	Jul.05	Aug.05	Sept.05	Oct.05	Nov.05	Dec.05	Jan.06	Feb.06	Mar.06	Apr.06	May06	Jun.06	Total
Bookings number	66	144	154	169	163	90	99	135	163	216	268	225	240	214	266	238	2346
Change (respect to the previous month)		118,2%	6,9%	9,7%	-3,6%	-44,8%	10,0%	36,4%	20,7%	32,5%	24,1%	-16,0%	6,7%	-10,8%	24,3%	-10,5%	
Runs number	64	135	143	157	148	82	92	128	147	180	239	204	210	192	229	215	2121
Change (respect to the previous month)		110,9%	5,9%	9,8%	-5,7%	-44,6%	12,2%	39,1%	14,8%	22,4%	32,8%	-14,6%	2,9%	-8,6%	19,3%	-6,1%	
Total Kms	2.261	5.682	6.099	8.519	7.163	7.083	4.981	6.358	6.970	8.158	12.545	8.127	9.906	11.800	16.087	12.581	105.652
Change (respect to the previous month)		151,3%	7,3%	39,7%	-15,9%	-1,1%	-29,7%	27,6%	9,6%	17,0%	53,8%	-35,2%	21,9%	19,1%	36,3%	-21,8%	
Total hours	372	731	813	1.027	846	1.009	739	1.062	1.151	1.894	2.422	1.384	1.814	1.651	2.310	2.100	16913,62
Change (respect to the previous month)		96,5%	11,2%	26,3%	-17,6%	19,3%	-26,8%	43,6%	8,4%	64,5%	27,9%	-42,8%	31,0%	-9,0%	39,9%	-9,1%	
Kms per run	35,33	42,09	42,65	54,26	48,40	86,38	54,14	49,67	47,41	45,32	52,49	39,84	47,17	61,46	70,25	58,52	49,81
Hours per run	5,81	5,41	5,69	6,54	5,71	12,30	8,03	8,29	7,83	10,52	10,13	6,79	8,64	8,60	10,09	9,77	7,97
Subscribers	68	82	106	129	143	155	169	192	204	222	242	247	247	251	260	272	247
Change (respect to the previous month)		20,6%	29,3%	21,7%	10,9%	8,4%	9,0%	13,6%	6,3%	8,8%	9,0%	2,1%	0,0%	1,6%	3,6%	4,6%	
Users (*)	25	45	59	53	47	34	43	61	58	72	97	82	79	81	83	81	
Change (respect to the previous month)		80,0%	31,1%	-10,2%	-11,3%	-27,7%	26,5%	41,9%	-4,9%	24,1%	34,7%	-15,5%	-3,7%	2,5%	2,5%	-2,4%	
Users to subscribers (%)	36,8%	54,9%	55,7%	41,1%	32,9%	21,9%	25,4%	31,8%	28,4%	32,4%	40,1%	33,2%	32,0%	32,3%	31,9%	29,8%	
Monthly Utilisation coefficient per subscriber	0,94	1,65	1,35	1,22	1,03	0,53	0,54	0,67	0,72	0,81	0,99	0,83	0,85	0,76	0,88	0,79	0,94
Monthly using coefficient per user	2,56	3,00	2,42	2,96	3,15	2,41	2,14	2,10	2,53	2,50	2,46	2,49	2,66	2,37	2,76	2,65	
USING DAYS	23	30	31	30	31	31	30	31	30	31	31	28	31	30	31	30	479
HOURS PER DAY PER VEHICLE	1,62	2,44	2,62	3,42	2,73	3,25	2,46	3,42	3,84	6,11	7,81	4,94	5,85	5,50	7,45	7,00	3,53
KM/RUN PER VEHICLE	9,83	18,94	19,67	28,40	23,11	22,85	16,60	20,51	23,23	26,32	40,47	29,03	31,95	39,33	51,89	41,94	22,06
RUN/DAY PER VEHICLE	0,28	0,45	0,46	0,52	0,48	0,26	0,31	0,41	0,49	0,58	0,77	0,73	0,68	0,64	0,74	0,72	0,44

(*) the users are subscribers that use the service at least one time at months

It is possible to evaluate the growing trend of the services during 2005. During the summer period (August/September) has been recorded a trend inversion in terms of bookings and trips even if the kilometres and using hours rates has not been substantial decreases.

The month of January 2006 has recorded the record in all the main parameters even if in May 2006 the Km number is the highest.

It is interesting to compare the data against the national ones and to see that the "Kms per trips" data is lower that the national one (58), while the "Hours per run" data is substantially close to the national data (8.02). An important parameter (Monthly utilisation coefficient per use) compared to the national data (1.3) shows a potential improvement

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

before reaching the saturation point of the service in Rome.

Energy

Given the lack of available baseline data for the energy consumption assessment, ITEMS and the do-something scenarios provided not relevant forecasts; the ex post measurement confirmed the “niche” status of the measure also in terms of fuel consumption and energy efficiency.

Summary WP 8.1 Set-up of a city centre clean zones							
Indicator (units)		Baseline	Do-nothing (2006)		Miracles scenario	Ex-post	Note
			Frozen	Trend			
R8.1/Eco.1.a	Cost for operating (E/inh)	0	0	0	0	0,005	Total costs for operating are 15000 Euro and include costs due to fuel, leasing, call center, parking facilities, etc.
R8.1/Eco.1.b	Income (E)	0	0	0	0	20000	Income coming from the 200 subscriptions
R8.1/Ener.1.a	efficiency of transport modes (MJ/pkm)		0,36	0,36	0,33	1.9 x 10 ⁻⁴ MJ/pkm	
R8.1/Ener.1.b	Vehicle fuel efficiency (MJ/veh-km)		1,1	1,1	1,0	0,028 MJ/veh-km	
R8.1/Env.1.a	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)11548 4	1)949 8 2)66.4 90	1)9455 2)6818 9	1)11.216 2)88.080	1) peak hour 2) all mean workday Baseline Rail Ring Area Other columns Whole city
R8.1/Env.1.b	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Baseline Rail Ring Area Other columns Whole city
R8.1/Env.1.c	emissions of C6H6 (kg/h and kg/day)	1)96 2)697	N/A	N/A	1)48,5 2)349,5	1) 60 2) 433	Rail Ring emissions : 1)peak hour 2)all mean workday
R8.1/Env.2.a	concentrations of CO (millig/m ³)	1.77	N/A	N/A	N/A	1.4	
R8.1/Env.2.b	concentrations of particulates (microg/m ³)	50.0	N/A	N/A	N/A	44.4	
R8.1/Env.2.c	concentrations of C6H6 (microg/m ³)	1)8.75 2)6.6	N/A	N/A	N/A	1) 5.55 2) 4.8	1) Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stat) (3) 2) Measured value by passive samplers method
R8.1/Soc.1.a	Acceptance (Likert scale 1-5)	No quantitative data available	N/A	N/A	N/A	3.15 cluster-control 2.90 cluster-confidence 2.81 cluster-anarchy 3.57 cluster efficiency 3.56 cluster-mistrust	
R8.1/Soc.2.a	acceptance	N/A	N/A	N/A	N/A	Population 3.06 3.15 cluster1 2.90 cluster2	Likert 1-5) Acceptance = how the satisfaction score takes

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing						Project: Miracles City: Roma	
Measure number: 8.1.2							
						2.81 cluster3 3.57 cluster4 3.56 cluster5	part of the different clusters of the local culture
R8.1/Soc.3.a	awareness (%)	N/A	N/A	N/A	N/A	14%	
R8.1/Soc.4.a	Use motivation (%)	N/A	N/A	N/A	N/A	24 cluster-control 12 cluster-confidence 9 cluster-anarchy 11 cluster efficiency 17 cluster-mistrust	
R8.1/Soc.4.b	Expectations towards involved agencies/bodies (%)	No quantitative data available	N/A	N/A	N/A	Administration invests in satisfaction for the citizen: -75.6; +24,39; Administration invests in services: -40.99; +59,01; Administration invests in production activities: -7,66; +92,34; Administration invests cultural heritage -13,55; +86,45	
R8.1/Soc.4.c	Satisfaction level (Likert scale 1-5)	No quantitative data available	N/A	N/A	N/A	3.06	
R8.1/Tran.1.a	modal split (motorized and non motorized) (% of the total flow)	1) a)20 b)48 c)11 d)21 2) a)30 b)27 c)23 d)20	1) a) 22 b)+c)53 d) 25	1) a) 22 b)+c)5 d) 25	1) a) 22 b)+c)53 d) 25	0,04	1)whole city 2)Rail Ring Area a)PT b)Priv 4-wheels c)Priv 2-wheels d)Walking
R8.1/Tran.1.b	traffic levels (trips day per vehicle)	2,2	2,5	2,5	N/A	1,12 0,44**	* at the beginning of the implementation **Consolidated average value
R8.1/Tran.1.c	trips (millions no.)	1)5,6 2)1,42	1)4.8* 2)1,53 **	1)4,9* 2)1,55 **	N/A	0,000012 ° 0,0021°°	1)whole city 2)Rail Ring Area ° at the beginning of the implementation °°Consolidated average value
R8.1/Tran.1.d	travelled people (no.)	0	No	No	N/A	140°	° at the beginning of the implementation

Table 1: ex-ante and ex-post measure indicators

N/A= data not available; No= no variation foreseen; T.B.C.= To Be Completed

* Data provided by local partners; ** ITEMS Data or elaborated from ITEMS Results

MEASURE-LEVEL RESULTS

Measure title: New forms of vehicle use – Car Sharing
Measure number: 8.1.2

Project: Miracles
City: Roma

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase Public awareness and support for sustainable mobility by 25%.	A good index of awareness (14%) was surveyed, along with a positive perception of the scheme and the value of the "satisfaction level" indicator was quite high (3.6 points, on Lickert scale 1-5).	A very good result considering that the car sharing service has been implemented on a quite small scale	☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Status of the Measure beyond MIRACLES – Upsacling

The 7th of March 2006 is finished the first experimental phase. The actual subscribers and the citizens that provided the joining demand want to know how the service will evolve.

For the moment ATAC, the service manager, is continuing the experience in order to not interrupt the service to the city.

The City of Rome is willing to continue the experience and the last agreement with ATAC is to encourage the service by expanding the fleet and extent in territorial terms the service. An hypothesis coming from ATAC of a second experimental phase in order to better understand the supply model should be approved by the Town Council in Autumn allowing ATAC to purchase twenty new cars and in parallel to prepare a tender to move the service to a private company.

Three new districts in the central part of Rome will be interested by the extension of the service next year.

New funds are expected from the Rome Municipality and the Environmental Ministry dedicated to the car sharing and the ICS sponsorship will provide Rome new incentives for the introduction of hybrid car in the fleet and for who wrecks his car and uses the car sharing.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The system is already technologically tested, taking advantage of the modularity and the specific characteristics of this kind of system.

One of the barriers to the implementation of the system, which caused some delays, was due to problems to access the funding from the Rome Municipality, which, even if available, was not accessible since designated to cost items were different from the expected ones. A long and complex procedure with the general Accountancy of the Rome Municipality has been followed to access to the funding. In addition the support to the Rome Municipality for the preparation of a law determination relative to the one-year experimentation of car sharing in Rome was produced

M13: Interrelationships with other measures

The car sharing system is completely integrated not only with the Local Public Transport, but also with other modes of sustainable transport such as the collective taxi, it is part of the Sustainable Mobility Strategy of the Municipality of Rome.

M14: Lessons learned

The results obtained from the experimentation phase of the project in Rome showed the relevance of the car sharing service within the sustainable mobility program. It also showed the primary importance of technology in the implementation of such a system.

Moreover, an adequate marketing campaign is enormously important. It should not only sell the service to the citizens, but also to the SME. To offer such service it is necessary to consider the fleet size and the effective use from the customers.

Contact person: Mr Carlo Gentile – ATAC SpA – email carlo.gentile@atac.roma.it

15. Measure 9.1 – New Concepts for distribution of Goods

MEASURE-LEVEL RESULTS													
Measure title: Kerbside-doorstep delivery	Project: Miracles												
Measure number: 9.1	City: Rome												
<i>The Measure – what is it about?</i>													
M1: Measure objectives:													
<p>The new concept for the distribution of goods was a multi scope measure. It was targeted to:</p> <ul style="list-style-type: none"> • Improve the communication between city authorities and goods operators • Improve the city logistic support, under the infrastructural point of view 													
M2: Measure description:													
<p>Since “kerbside-doorstep delivery” was meant as a “soft measure”, the core of the measure was to develop a feasibility study to improve goods delivery conditions in the Laboratory Area.</p> <p>The study focused on:</p> <ul style="list-style-type: none"> • Establishment of load/unload areas inside pedestrian precincts of the historical city centre within specific slots, or “time-windows”; • Determine which main streets should have a ban on load/unload procedures within set time periods; • The possibility to locate loading/unloading areas for night operations • Improve collaboration with operators of home delivery services 													
<i>The Implementation – how was the measure implemented?</i>													
M3: Innovative aspects:													
<p>The Rome municipality would like to apply best practice initiatives developed in other EU cities, to improve the logistic system specifically in the Limited Traffic Zone (LTZ), to avoid congestion and to optimise itineraries. The feasibility study therefore focused on the comparison between place performances and user demand. This was innovative, since former studies had been concentrated on the assessment of quantitative data concerning modes and delivery features in the city goods delivery system.</p>													
M4: Situation before CIVITAS:													
<p>Surveys on goods deliveries were undertaken in the late 90’s. The general framework for development of the transport plan was approved in year 2000.</p> <p>Freight entering the City was about 90,000 tonnes/day; the historical centre (LTZ) represents 1.1% of the surface area of the city of Rome but absorbs 33% of the freight. About 35,000 freight vehicles/day enter the FLTZ (Freight Limited Traffic Zone – larger than LTZ but included in the Laboratory Area of MIRACLES).</p> <p>The infrastructure for goods deliveries in the LTZ was not ideal and the number of bays for unloading/loading goods, as shown in figures 1 and 2 (in which some areas of the city centre are taken as samples), was very low comparing to the planned ones.</p>													
<div style="display: flex; align-items: flex-start;"> <div style="flex: 1;"> <p>Figure 1</p> <p style="writing-mode: vertical-rl; transform: rotate(180deg);">D.I.T.S. Localization of load/unload lots in studied</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>IX Area, Pigna</p> <p>X Area, Campitelli</p> <p>XII Area, S. Angelo</p> <div style="margin-top: 10px;"> <p>— Border of the area</p> <p>— Main commercial streets</p> <p>● Current lots</p> <p>● Planned lots</p> </div> <table border="1" style="margin-top: 10px; font-size: small;"> <thead> <tr> <th>Area</th> <th>Pigna</th> <th>Campitelli</th> <th>S. Angelo</th> </tr> </thead> <tbody> <tr> <td>Current lots</td> <td>4</td> <td>1</td> <td>2</td> </tr> <tr> <td>Planned lots</td> <td>8</td> <td>5</td> <td>7</td> </tr> </tbody> </table> </div> <div style="width: 50%; text-align: center;"> </div> </div> </div> </div>		Area	Pigna	Campitelli	S. Angelo	Current lots	4	1	2	Planned lots	8	5	7
Area	Pigna	Campitelli	S. Angelo										
Current lots	4	1	2										
Planned lots	8	5	7										

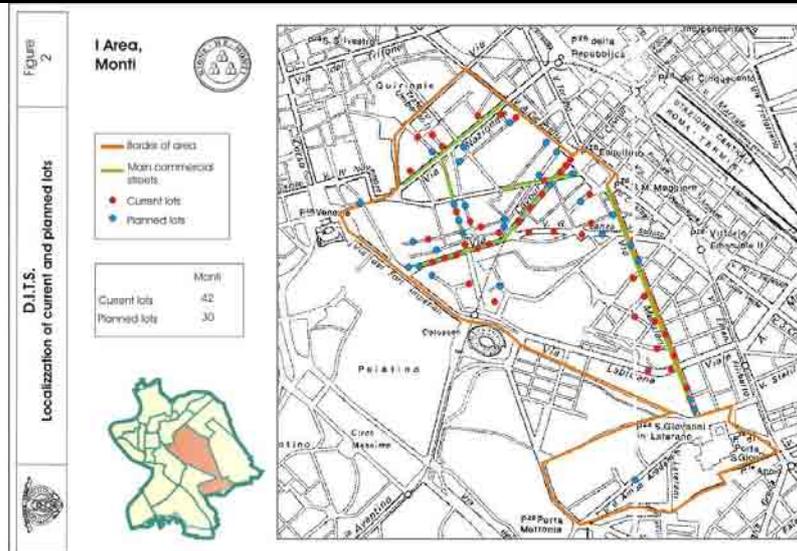
MEASURE-LEVEL RESULTS

Measure title: Kerbside-doorstep delivery

Project: Miracles

Measure number: 9.1

City: Rome



Figures 1, 2 – Situation of existing (in red) and planned (in blue) lots in some areas of city centre

M5: Design of the measure:

The Municipality of Rome implemented a pilot project to support the new logistic provision in the city centre and, accordingly, ATAC promoted a feasibility study, concerning mainly: user need analysis, impact surveys, operational plan and load/unload lots in the LTZ area. The feasibility study was aimed at defining gaps and potentialities of central areas, in sight of the localisation and establishment of load/unload areas, as reported in M2, and of the opportunity to implement night operations.

To run the feasibility study, the following steps were undertaken

- Examination of the delivery network, in the LTZ
- Data collection, through the operating ACS – Access Control System in the STA (Municipal Traffic Control Agency) traffic control centre, to support the scheme and use of the specific time-window slots.
- Definition and design of the requested amount of parking lots.

M6: Actual implementation:

It is not proper to talk about actual implementation, since the measure was focussed on the feasibility to upgrade the current loading/unloading areas supply in the city centre, hence at theoretical level.

The study, however, began in June 2002, with the data collection and the delivery network analysis, and achieved first results in May 2005. Consolidated results were achieved in Fall 2005.

M7: Deviations from the plan:

This Workpackage on freight distribution, following the amendment submitted in 2004, was fine tuned according to the actual situation in Rome. In fact the Site Manager realised that within the MIRACLES timescale only the design phase could have been developed, that's why it has been highlighted as a "soft measure"

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For measure 9.1. deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: removed because no changed occurred in terms of infrastructure

- *Cost for maintenance*: removed because no maintenance occurred.

- *Income from parking*: removed because no pricing was applied.

Evaluation category: *Environment*

- *Emissions of NOx*: substituted with C6H6 emissions because more relevant

- *Concentrations of NOx*: substituted with C6H6 concentrations because more relevant

Evaluation category: *Society*

MEASURE-LEVEL RESULTS

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- *Operators acceptance, Acceptance, Use motivation, Awareness, Satisfaction level*: removed because the interviewees did not provide a relevant number of replies to build a consistent sample

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Since the measure was based on a feasibility study, assumptions on indicators and impacts were made on the basis of the results achievable and achieved by other really-implemented measures. This meant that for instance, environmental results due to the implementation of measures from WP5 or WP6, being the widest in terms of application and coincident in terms of implementation area, have been assumed also for measure 9.1.

Hence, the various tools and data sources used to calculate the indicators for this measure were the same of the other measures. They are reported as follows:

Environment

Referring to 2001 baseline year, emissions and concentrations data were taken from “Air quality report on city status” Report. For what concerns the do-nothing scenario, emissions of CO and of particulates in ITEMS study were expressed in t/year. To change these data in kg/days so to be comparable to baseline data provided by local partners, values were divided for the number of days in year (364). To obtain kg/hour in peak hour, the daily emission was divided by seven, since seven is the proportion factor observed between daily and hourly emissions.

For what concerns Benzene, since ITEMS didn't provide data on this pollutant, emissions have been calculated by a linear progression, taking into account values issued in the Rome Municipality Air Quality Report, years 2001 – 2003; such basic calculation allowed to esteem a trend scenario in which C6H6 decreases. Values of emissions provided by local partners referred to rail ring area, while the values elaborated from ITEMS referred to the city-wide network.

Concentrations of pollutant were not provided by ITEMS, given the difficulties of calculations. Indeed, to have such data, models processing multi-information, such as for instance a 3D scheme of the built environment, would be the more appropriate tools. However, a more approximated, easier way to calculate them was run taking into account variations surveyed in years 2002 and 2003 in Rome by ARPA Lazio (Lazio Region Environmental Protection Agency). The year 2006 data was hence calculated by the assumption of a linear variation, for the trend scenario.

Transport

Referring to 2001 baseline year, the transport indicator value, number of “bay of deliveries”, was taken from a study run by DITS on transport of goods in the city centre, funded by ATAC.

Also in this case, linear variations were studied by DITS to estimate a possible improvement of the number of “bays for deliveries” (about 10%) for the trend scenario.

M9: Achievement of quantifiable targets:

No quantifiable targets were foreseen, being the measure considered as a soft one.

M10: Achievement of evaluation-related milestones:

The milestones generally coincided with the original timings set out in the evaluation plan.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and steps to achieve the objectives

a) The measure outcomes

The indicators for evaluating this measure were divided into two sections: Environment and Transport.

Since it was impossible to split the contribution due to commercial vehicles from the overall pollution level, because of the lack of reliable data, considerations under the environmental point of view, were general.

Emissions and concentrations of all pollutants (in general) decreased in the trend and frozen scenario as shown below (Tables 1 and 2), probably because old polluting cars were replaced with new ones.

As mentioned in M8, emissions and concentrations values of C6H6 were evaluated by DITS assuming, only for the trend scenario, a linear interpolation of values reported by Rome Municipality air quality report in year 2001 and 2002. As for the other pollutants, C6H6 values decrease for both emissions and concentrations.

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	emissions of CO 1)kg/h, peak hour 2)kg/day, all mean workday (elaborated from ITEMS)	emissions of particulates 1)kg/h, peak hour 2)kg/day, all mean workday (elaborated from ITEMS)	emissions of C6H6 1)kg/h, peak hour 2)kg/day, all mean workday (elaborated from ITEMS results and Rome Municipality air quality report)
Value (2001) (referred to Rail Ring Area)	1)56.889 2)372.895	1)35,35 2)271	1)96 2)697
Value ITEMS Baseline (referred to whole city)	1)16497 2)115484	1)76,7 2)536,9	
Value ITEMS Frozen (2006) (referred to whole city)	1)9498 2)66.490	1)52,8 2)369	
Value ITEMS Trend (2006) (referred to whole city)	1)9455 2)68189	1)52,4 2)367	1)48,5 2)349,5

Table 1 – Pollutants emissions for the trend and frozen scenarios

Variations of the Transport indicator “Number of bays for deliveries” were evaluated in the do-nothing trend scenario by supposing an improvement of bays of delivery of 10% in five years. This assumption was made in accordance with the outcomes from the feasibility study on user need and places performances, run by DITS. Moreover, two main aspects were studied to determine the need of bays and lots: to improve the delivery network thereby allowing night operations, and to ensure resident parking places.

Both aspects were also consistent with one of the measure’s main objectives i.e. to determine which main streets were suitable for load/unload bans within specific time-windows. As an example, a representative street of the city centre, in the Monti Area, (shown in figure 2) Via dei Serpenti, was studied. The number of lots needed was evaluated using a coefficient, developed on this purpose. This coefficient was aimed at evaluating daily attractiveness of commercial vehicles. The value of this coefficient varied with each kind of commercial activities, and it was obtained by interviews to retailers. A count survey of commercial vehicles operating on Via dei Serpenti confirmed the results obtained by the attractiveness coefficient. In Figure 3 and in figure 4 is shown the need of lots for load/unload goods along the sample street (Via dei Serpenti).

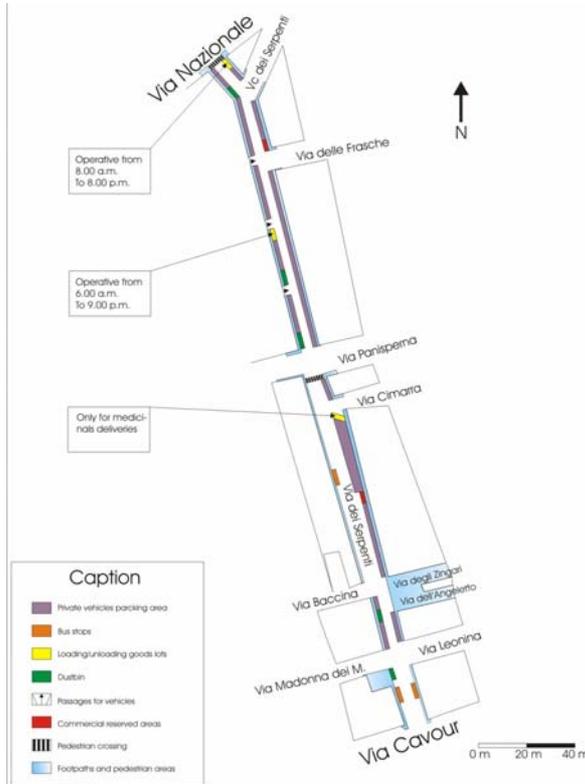


Figure 3 – Current situation in Via dei Serpenti

MEASURE-LEVEL RESULTS

Measure title: Kerbside-doorstep delivery

Project: Miracles

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Figure 4 – Need of lots

Such an increase of lots should provide sufficient capacity to enable night-time deliveries. However, this is not practical on tourist streets, which are still lively during night-times.

Figure 5 illustrates those tourist streets which were considered “no night delivery operations” zones.

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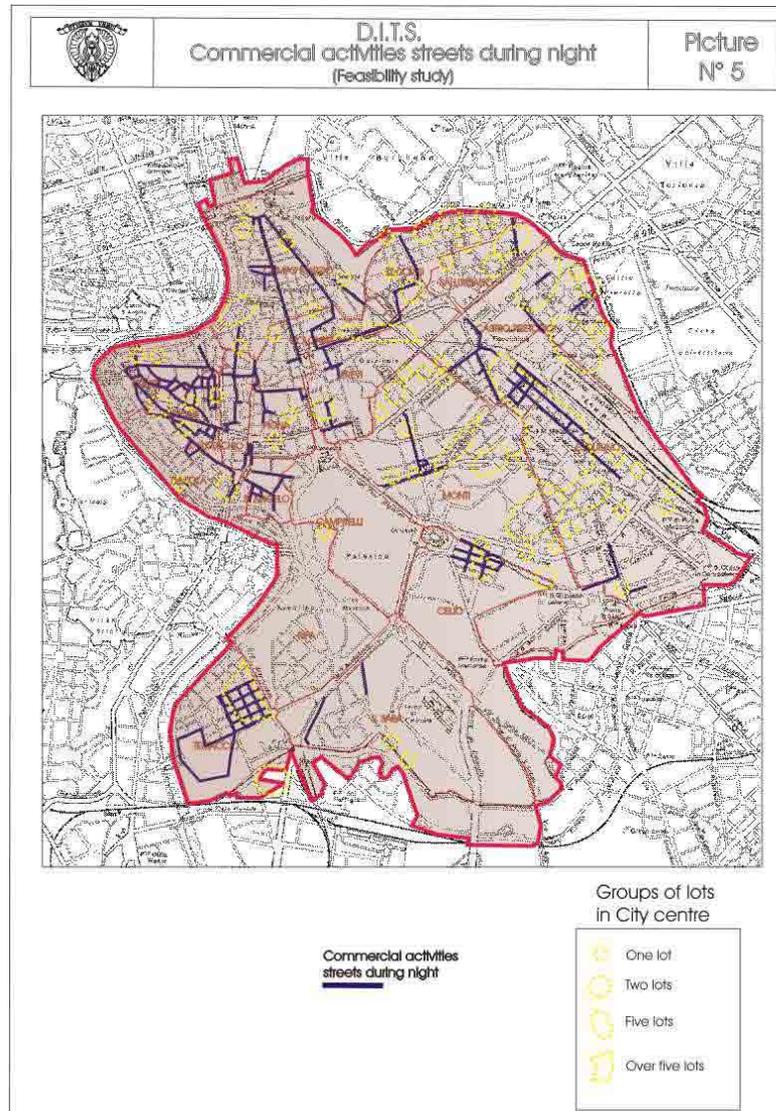


Figure 5 – Commercial activities streets during night

The need for residential parking was taken into account, since the creation of new bays for deliveries usually means less parking lots for residents. The two requirements were compared and weighted in favour of new parking lots. Interpolating the results obtained for Via dei Serpenti, as sample street, to downtown level, it was estimated that about 643 new lots were required in accordance with city development and the MIRACLES activities. This result was also confirmed also by results from other non-MIRACLES studies. It was reasonable however to consider a smaller amount of lots (about 600), since other hindrance factors as driveways, garbage collection points, no parking areas for administrative, religious, tourist purposes reduced the available space.

In table 3 is reported an Ex ante evaluation indicators summary

MEASURE-LEVEL RESULTS

Measure title: Kerbside-doorstep delivery

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Summary WP 9.1 Kerbside-doorstep delivery						
Indicator (units)		Ex ante				Ex post
		Baseline	Do-nothing (2006)		Miracles Scenario	
			Frozen	Trend		
R9.1/Env.1.a-c	Emissions [CO, PM, C6H6] (Kg/h, Kg/day)	see Table 1	see Table 1	see Table 1	N/A	CO 1)11.216 2)88.080 PM 1) 21,2 2) 153 C6H6 1) 60 2) 433
R9.1/Env.2.a-c	Concentrations [CO] (Millig/m ³) [PM, C6H6] (Microg/m ³)	see Table 2	see Table 2	see Table 2	N/A	CO 3)1.4 PM 1) 44.4 C6H6 1) 5.55
R9.1/Tran.1.a	Bays for deliveries	183		201	643	190

Table 3 - Ex-ante – Ex post evaluation Rome MIRACLES Measures

N/A= data not available; 1) peak hour 2) all mean workday 3) monitored by the network

A) comparison between quantifiable objectives and steps to achieve the objectives (see Table)

Planned objectives	Steps to achieve the objectives	Notes	Achievement certainty
1) Reduced delivery times (rationalised planning/enforcement); operational savings, energy & pollution reductions.	Implementation of strategy B and related measures	<i>See upscaling description at the end of this section</i>	☺☺☺
2) A set of solutions (output of the simulations), tuned on funding available, acceptability by users, calibrated on the user needs and ready to be implemented by Municipality.	Implementation of strategies A and B and related measures	<i>See upscaling description at the end of this section</i>	☺☺☺
3) Increase freight operators satisfaction index	<i>Operators participation in the governance process is a must; however, operators wariness and their categories fragmentation hindrance any form of co-operation</i>		☹
4) Goods operator coordination and cooperation, including willingness to subscribe rates.			☹
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Status of the Measure beyond MIRACLES and Upsacing

The studies concerning the measure will continue beyond MIRACLES - Upscaling activities could be first related to a general conversion of parking places into load/unload lots at city level, in those areas where commercial attractiveness is strong; such conversion however should also face problems related to the poor supply of parking in general, so solutions can be found only when the general parking problem is solved. This seems to be a vicious circle, but it is, in reality, a prerequisite for any further implementation.

The upscaling exercise was run hence, simulating how the upgrading of the parking supply can be achieved in other urban areas, and then developing strategies to improve the overall delivery process.

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The exercise focused on an area at the border of the city centre (Piazza Fiume), and was developed by DITS according to an in-house procedure; researchers were asked to estimate the feasibility of implementing strategies, once the basic parking requirements were met, on the basis of on-the-spot surveys, Delphi questionnaires and brainstorming sessions. Local operators supplied data on the delivery habits and procedures. Piazza Fiume area was selected because of its close “resemblance”, in terms of commercial and infrastructural features, to the historical centre.

The steps of the upscaling exercise were:

- a) Data collection on the local field of application, in particular along the most relevant street (Via Salaria in Figure 6) of the area
- b) Individuation of the proper number of loading/unloading lots along Via Salaria
- 3) Development of strategies to improve the overall delivery system in the area Piazza Fiume area



Figure 6 – Via Salaria study area

Data collection on Via Salaria

Local retailer provided data on usual delivery operation, thanks to questionnaires distributed to all the shopkeepers of the street and to face-to-face interviews. This allowed assessing data as, for instance, how many delivery vehicles operate daily per type of retail facility, in average (Figure 7). Spot surveys enabled to assess average time due delivery operations or whether delivery operations occurred in the dedicated areas or not (Figure 8).

Identification of the proper number of loading/unloading lots along Via Salaria

Once that quantitative data were collected, the exercise was developed applying the coefficient of attractiveness calculation, as for the city centre case study commented above. Calculation allowed esteeming the required number of loading/unloading areas matching also with physical hindrances as driveways or bus stops.

Hence, the number of loading/unloading areas passed from the 3 already available to the 7-11 needed ones, according to the survey.

MEASURE-LEVEL RESULTS

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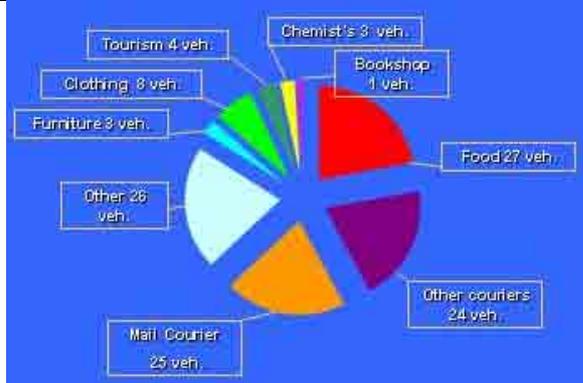


Figure 7 - Delivery vehicles operating daily per type of retail facility, average



Figure 8 – Load/unload areas at Via Salaria

Development of strategies to improve the overall delivery system in the area Piazza Fiume area

Once defined the proper number of loading/unloading areas for a given street, i.e. once met the basic requirement of parking both for commercial and residential activities, it was possible to enlarge the study defining further strategies to improve the delivery organization system at a decision-makers level.

The first step became then the definition of objectives for the development of the improvement strategies/scenarios; according to the MIRACLES lesson, achievable goals could be:

- Increase of the delivered load by 15 %
- Rationalization of the delivery process
- Promotion of eco-friendly vehicles for delivery operations

They allowed developing three strategies/scenarios, described in Table 4. These were different, in terms of increasing complexity of application (quantity and quality of the measure to implement) and in terms of “premium” benefits; i.e. the more complex scenario, the best results.

Scenario A was aimed at meeting operators requirements so to have an increase of the loading factors; measures to achieve the goal were related to the regulations, infrastructural and management domains; expected results should reduce deliveries fragmentation and not efficient operations. This scenario was considered a soft one because it was just targeted to control and reduced accidental and not organized operations and to prevent shopkeepers from making delivery operations by themselves.

MEASURE-LEVEL RESULTS

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Scenario B was aimed at amending the infrastructural parking situation; indeed, most of the measures were targeted both to improve physically the parking supply and operatively the delivery processes, especially for what concerned time and way of perform such activities.. Needless to say that the difference with the previous scenario relies on the highest cost of the measures requested by scenario B.

Eventually, *Scenario C*, the most complex, was virtually dedicated to meet environmental requirements: this means that to put into practice the scenario's measures, political will and operators acceptance had to be pursued first, being the set of measures very restrictive (due especially to the pricing for not eco-friendly vehicles). This was also a very long-term scenario, so its feasibility must be based also on the possibility to achieved the expected environmental benefits in a very long time.

Table 5 shows the level of influence (high, medium, low) of each single measure on the possibility to meet the list of requirements, divided per macro areas (sustainability, operations, timing, safety and security, etc.). Such requirements came from the needs as achieved by the interviews with local retailers.

Objectives:		
<ol style="list-style-type: none"> 1. Increase of the delivered load by 15 % 2. Rationalization of the delivery process 3. Promotion of eco-friendly vehicles for delivery operations 		
Strategies/Scenarios		
A	B	C
<p><i>Achievable objective: 1</i></p> <p><i>Measures:</i></p> <ul style="list-style-type: none"> ▪ Check on vehicles with carried load less than 1,5 t ▪ Routes optimization ▪ Vehicles Routing ▪ Creation of a TP - transit point ▪ Delivery to TP during off-peak hours <p><i>Expected outcomes</i></p> <ul style="list-style-type: none"> ▪ Reduction of the number of delivery vehicles ▪ Reduction of the number of unfulfilled deliveries ▪ Improvement on air quality <p><i>Prerequisites</i></p> <ul style="list-style-type: none"> ▪ Specific regulations ▪ Control <p><i>Accompanying measures</i></p> <ul style="list-style-type: none"> ▪ On-board Pos ▪ Fleet centralization 	<p><i>Achievable objective: 2</i></p> <p><i>Measures:</i></p> <ul style="list-style-type: none"> ▪ Time permits ▪ Creation of loading/unloadin areas ▪ Creation of lanes multifunction ▪ Creation of a TP - transit point ▪ Delivery to TP during off-peak hours ▪ Delivery to TP during night hours ▪ Loading/unloading area booking ▪ Routes optimization <p><i>Expected outcomes</i></p> <ul style="list-style-type: none"> ▪ Reduction of the delivery time by 15% <p><i>Prerequisites</i></p> <ul style="list-style-type: none"> ▪ Specific regulations ▪ Control <p><i>Accompanying measures</i></p> <ul style="list-style-type: none"> ▪ On-board Pos ▪ Fleet centralization 	<p><i>Achievable objectives: 1, 2, 3</i></p> <p><i>Measures:</i></p> <ul style="list-style-type: none"> ▪ Time permits ▪ Check on vehicles with carried load less than 1,5 t ▪ Creation of loading/unloadin areas ▪ Creation of lanes multifunction ▪ Pricing for not eco-friendly vehicles ▪ Creation of UDC – Urban Distribution Centers ▪ Loading/unloading area booking ▪ Routes optimization <p><i>Expected outcomes</i></p> <ul style="list-style-type: none"> ▪ Reduction of the number of delivery vehicles ▪ Reduction of the number of unfulfilled deliveries ▪ Reduction of the delivery time by 15% ▪ Improvement on air quality <p><i>Prerequisites</i></p> <ul style="list-style-type: none"> ▪ Specific regulations ▪ Control <p><i>Accompanying measures</i></p> <ul style="list-style-type: none"> ▪ On-board Pos ▪ Fleet centralization

Table 4 – The Scenarios and the related measures

MEASURE-LEVEL RESULTS

Measure title: Kerbside-doorstep delivery

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Requirements	sustainability			parking				Safety security			Illegal behaviors		Operations			Time				Control
	Congestion reduction	Fuel consumption reduction	Environmental impact reduction	Free parking	Parking booking on given period	Reduction time spent looking for parking	Optimization of occupancy time during delivery stops	Safeguards from thefts	Accidents reduction	No 2 nd man on-board	Respect of dedicated lanes	No LTZ illegal entrances	Optimization travel lengths	Optimization of number of operations per travel	Maximize average load factor	Reduction accessing time to the city centre	Optimization travel times	Optimization routing time within the LTZ	Optimization of operations times	
measures																				
Check on vehicles with carried load less than 1,5 t	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Routes optimization	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Vehicles Routing	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Creation of a TP - transit point	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Delivery to TP during off-peak hours	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Time permits	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Creation of loading/unloadin areas	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Creation of lanes multifunction	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Delivery to TP during night hours	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Loading/unloading area booking	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Pricing for not eco-friendly vehicles	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Creation of UDC – Urban Distribution Centers	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
On-boardPos	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Fleet centralization	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
Caption	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue
	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Light Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue	Dark Blue

Table 5 – Level of influence of the measures of the three scenarios on the selected requirements

To assess the suitability of each proposed scenario, a multicriteria analysis was applied, providing a different

MEASURE-LEVEL RESULTS

Measure title: Kerbside-doorstep delivery

Project: Miracles

Measure number: 9.1

City: Rome

weight to each measure, according to its influence level (high = weight 3, medium = weight 2, low = weight 1). It was possible to evaluate in this way not only how much successful a given scenario could be, but which were the most effective measures in relation to the requirements expressed by the interviewees, as synthesized in Table 6.

<i>Requirements</i>	Sustainability	Parking	Safety and security	Illegal behaviors	Operations	Time	Control	Total
<i>Scenarios</i>								
Scenario 1	43/45	19/60	1/45	12/30	27/45	29/60	3/15	134/300
Scenario 2	44/72	55/96	5/72	27/48	54/72	73/96	15/24	273/480
Scenario 3	55/72	55/96	4/72	33/48	42/72	51/96	11/24	251/480

Scores are referred to the highest achievable values for each class of requirement, for each considered scenario; for instance, in scenario 1, sustainability achieves the score of 43, when 45 is the achievable maximum., which is obtained providing with a weight 3 each item belonging to the sustainability class.

■ Possibility of minor success to meet the class of requirements

■ Possibility of major success to meet the class of requirements

Table 6 – Possibility of success of each scenario

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The feasibility study stressed some factors peculiar to the city of Rome, so it is very difficult to assess an overall transferability of the study results. However, an important consideration is the parking requirement. Once this basic requirement is met, every other intervention is possible. In Rome, given the poor supply of load/unload areas, any extra action in terms of fleet renewal, e-commerce development, logistic platforms location, etc. must be postponed.

Another point to consider was the feeling of wariness by the local operators; they were not ready to discuss, so it was very difficult to have a proper knowledge of their requirements.

M13: Interrelationships with other measures

WP 5.1; WP11The measure forms a part of the Clean Zone package in Rome, integrated with traffic control centre.

M14: Lessons learned

Historical cities have their own specific difficulties when they have to deal with delivery networks. Political will is essential for any improvement in this domain, but will becomes not sufficient when the built environment has a higher value, the provision of loading / unloading areas is poor, and there is a wariness feeling between residents and operators. The solution then has to be a compromise to which all the involved actors must agree with.

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16. Measure 10.2 – Mobility Management

MEASURE-LEVEL RESULTS	
Measure title: Mobility Management Measures	Project: Miracles
Measure number: 10.2	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Original objectives were:</p> <ul style="list-style-type: none"> • Implement commuter planning and integrated mobility management tools • Raise awareness about HWTP (Home-to-Work Trip Plans) alternatives <p>These general objectives have been pursued through the following operative objectives:</p> <ul style="list-style-type: none"> • Encourage the companies to appoint Mobility Managers, in order to increase their number in Rome; • Provide support to the Mobility Managers in implementing commuter plans and integrated mobility management tools; • Provide the Mobility Managers with support to catch opportunities for funding; • Raise awareness about commuter plans alternatives; 	
M2: Measure description:	
<p>The measure is set up in order to perform the following:</p> <ul style="list-style-type: none"> ○ Set up of a “Help Desk” for Rome Mobility Managers (Specific web pages with restricted access area for Mobility Manager will be activated on the ATAC web site) ○ “On demand” development of specific of Commuter Plans within the Demonstration area, ○ Elaboration and proposal of solutions with standardised methodology for O/D and mobility patterns for Company Mobility Managers. ○ Development of projects for HWTP to major destination poles in Rome (University “La Sapienza” and Auditorium “Parco della Musica”), located in the Demonstration Area. ○ Design and implementation of company dedicated bus lines – and stops – located in the Laboratory Area; ○ Organization of awareness campaigns for Company Mobility Managers with specific reference to the new laws, regulations and incentive tools issued by the Municipality. ○ Design and activation of new Commuter plans in compliance with new Municipality Deliberation n. 577/2003. 	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The innovative aspect of the measure is the support given to change from long ingrained ways of making transport decisions, realized involving support for business in establishing the financial case for individuals and Companies to change modal shift towards Collective Transport.</p>	
M4: Situation before CIVITAS:	
<p>In 1998 the so-called Ronchi Decree has introduced the figure of the Mobility Manager, both at the city level (Mobility manager for the Area of Rome) and for the companies and local authorities with more than 300 employees for local unit, or with more than 800 employees allocated in several branch offices.</p>	
M5: Design of the measure:	
<p>ATAC is the “Mobility Manager of Rome” and is in entitled to support from a legal, administrative and technical point of view the Mobility Managers appointed by the companies. ATAC has therefore an important role of coordinator between the political level (such as the Ministry of Environment, the City Council, the councillorships and the public and private transport companies) and the management level (companies’ Mobility Managers);</p> <p>The role of the “Company Mobility Manager” consists in stimulating the employees to optimise their commuting plan, setting up crews for car pooling, providing information on all the opportunities and initiatives aiming at stimulating the use of collective transport.</p> <p>Company Mobility Managers have been so far supported by ATAC in the preparation of the commuters’ Plans with a co-funding by the Environmental Ministry and, within the MIRACLES framework, with an Help Desk (technical and legal); they also have been involved in special events and information days on the opportunities offered by the City Council and by the European Union through MIRACLES.</p> <p>The WEB services for Mobility Managers has been designed in order to allow the restricted access inside the pages of sustainable mobility in ATAC web site (www.atac.roma.it). Mobility Managers can therefore submit their best practices, take part in thematic forums, use the available databases and download files, presentations and useful information.</p>	

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

Project: Miracles

Measure number: 10.2

City: Roma



Figure 1 – The Mobility Manager dedicated section on ATAC web site

Commuter Plans have been engineered with the “O/D” matrix (Origin/Destination) of the employees provided by the Mobility Managers. A cross-evaluation with results achieved and experiences gained in other European cities via the MOST methodology was used to fine tune sustainable mobility strategies; several surveys have been carried out.

The HWTP has to be followed by an Detailed Operative Plan (POD) where the HWTP is detailed described with plan support campaign, service assignment, implementation time, service management and monitoring, financial plan.

M6: Actual implementation:

The present situation of the Mobility Managers appointed in Rome is described in Fig.2 below



Figure 2 – Trend of Mobility Managers appointed in Rome

1) The New Commuter Plans projects submitted and funded by the **Environmental Ministry** for the period 2002/2005 have been:

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

Project: Miracles

Measure number: 10.2

City: Roma

Company name:	Funding awarded (€)
Alitalia Airport	294.674,81
Alitalia New Headquarter (NCD)	34.241,09
ENEA	565.182,54
ENEL	64.593,26
INPDAP	121.367,37
SVILUPPO ITALIA	139.443,36
TIM	206.5108,20
UNIVERSITY "LA SAPIENZA"	524.410,34
SANTA CECILIA ACADEMY	61.974,83
UNIVERSITY "ROMA TRE"	309.874,14



Figure.3 - the shuttle bus of the University "La Sapienza"

2) Further to the Commuter Plans listed above, the **City Council** has decided to award funding, through deliberation 577/03, for co-financing new Commuter Plans.

The following companies have submitted application for the new funding:

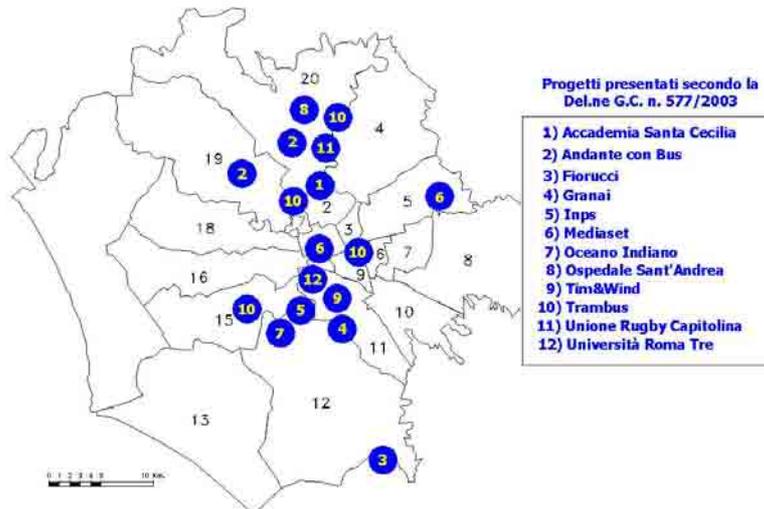


Figure 4 – distribution of the projects submitted

Nowadays 9 out of the 12 plans have been approved, and three of them have started to be operational. By the end of 2006, all the 9 plans will be in place.

M7: Deviations from the plan:

Compared to the description of work described in the Technical Annex no deviations have occurred, the plans and milestones have been kept to schedule.

Referring to categories financed by "Bordon" ministerial decree, the new ministerial decree finances also services

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

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for specific attractor/generator shifts places such as Universities, theatres and commercial centres. Anyway for these categories have been supported cooperation among companies and integration with PT network.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For measure 10.2 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: not relevant and not quantifiable

Evaluation category: *Society*

- *Operators acceptance, Acceptance, Use motivation, Awareness and Satisfaction level*:: removed because the interviewees carried out by DIPPSI did not provide a relevant number of replies to build a consistent sample

Evaluation category: *Transport*

- *Modal split*: the available data is that in average 1.000 pers/day take advantage of the Commuter Plans, this data is insignificant for Rome, and thus it has been removed.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

For what concerns the **Society** indicators, the methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis by DIPPSI of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called “dense words” in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

All other data and information came from ATAC dedicated database, on the basis of counting and surveys. For the MIRACLES scenario calculations were elaborated by DITS.

M9: Achievement of quantifiable targets:

One of the most important targets was the implementation of 13 companies projects. ATAC supported this process helping in defining technical procedures and in preparation of applying models for founding.

All projects were presented before according to the schedule of the Municipal Administration.

Nowadays 189 Mobility Mangers have been appointed in Rome, achieving an increase of 25% compared to the outset

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; in particular the main target of this measure was to improve and incentive the use of Collective transport, by addressing the companies employees, increasing the level of awareness on the opportunities offered by not using the private car.

The results seemed to be difficult to esteem at city level, (reduction of environmental impact and of traffic), but could be enough to justify an economic investments by the involved companies, and anyway, some data were collected by the involved mobility managers, concerning the modal split, here follow some examples, that confirm a positive trend towards collective transport.

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

Project: Miracles

Measure number: 10.2

City: Roma

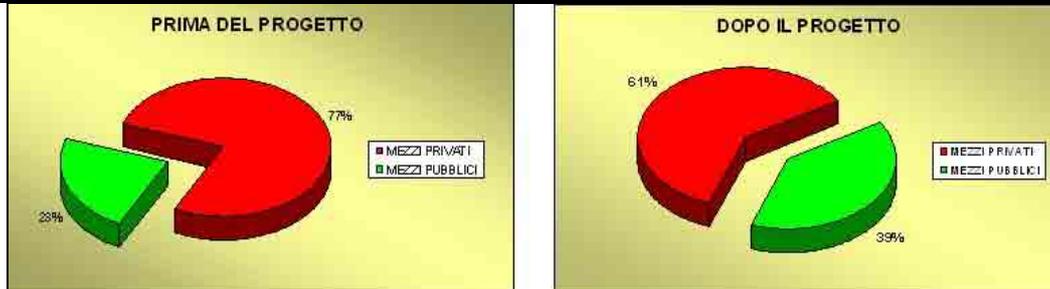


Figure 5 – "Company : Sviluppo Italia" green transit, red private modes

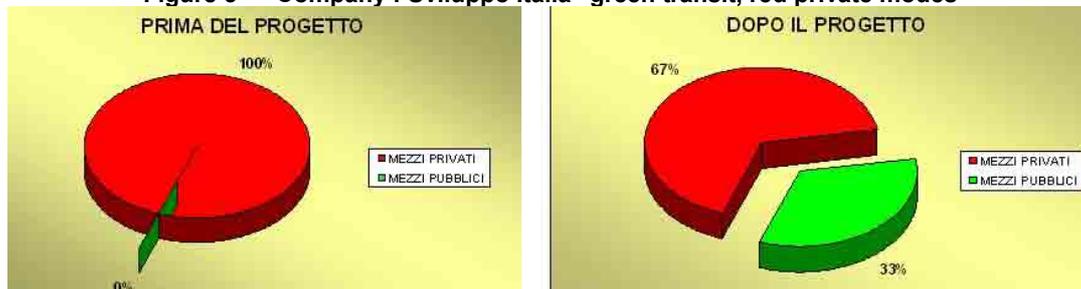


Figure 6 - Company: "Auditorium - Accademia di Santa Cecilia" green transit, red private modes)

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) Outcomes coming from the do something scenario, also called Miracles Scenario
- b) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- c) A comparison between quantifiable objectives and actual achieved results

a) The MIRACLES Scenario

Data for the do-something scenario for this measure were developed starting from the report called "La mobilità sostenibile: il mobility manager ed i veicoli elettrici" (Sustainable mobility: mobility manager and electric vehicles), edited by the Rome Municipality in 2003. Transport indicators showed an increasing of use of PT, and both for TIM and La Sapienza cases it was possible to observe a variation in the PT use by both companies' employees. For the TIM project, before the measure only 11% of employees used PT to reach working premises; in the do-something scenario the percentage doubled, reaching 24%. For La Sapienza project, the expected variation was different to the TIM one because the percentage of employees using PT increased by 11%, from 61% to 72%. It must be underlined that the percentage of employees using PT in the two involved Companies were so different because La Sapienza University is located in a well linked area of the city and very close to an underground station ("Policlinico station"), instead TIM premise was pretty far from any underground station.

Environmental impact due to implementation of this measure was esteemed in a reduction of 7,5 million of vehicles/km year, a reduction of CO emission of about 67,2 t/year and a reduction of benzene emission of 239,2 t/year. A reduction in fuel consumption was esteemed in about 244 t/year.

b) The measure outcomes

All results for ex-ante and ex-post scenarios are reported in Table 1 and commented according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex. Goals were to implement commuter planning and integrated mobility management tools and to raise awareness about HWTP (Home-to-Work Trip Plans) alternatives, so to increase Public awareness and support for sustainable mobility by 25% and contributing to increase the overall collective vehicle occupancy by 20%

Transport

The success of the measure can therefore be assessed by the hugely increased number of participants, which exceeded the results foreseen in the ex-ante evaluation. In 2002, there were 2,391 regular participants of HTWPs and they belonged to just two bodies (a private company and a university). As of October 2005, the average user number was 41,805 units, "consuming" 15772 vkm. Also for what concerns the number of mobility managers in charge of developing new HTWPs, it increased noticeably with 25% new nominees.

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

Project: Miracles

Measure number: 10.2

City: Roma

Summary WP 10.2 Mobility Management measure						
Indicator (units)	Baseline	Do-nothing (2006)		Miracles scenario	Ex-post	Note
		Froze n	Trend			
R10.2/E con.1.a	System operating costs (€)	7855,2	No	No		1.000.000 €/year (24 €/part.) Budget allocated for the Rome Municipality
R10.2/Tr an.1.b	average time for reaching workplaces (min.)	Commuter plan Sapienza: 50 min Home to work plan TIM: 43 min	No	No	N/A	31,125 min
R10.2/Tr an.1.c	participants per company (%)	Commuter plan Sapienza: 2279 users of PT system Commuter plan TIM: 112 users of PT system	No	Commuter plan Sapienza: 2271 users of PT system Commuter plan TIM: 112 users of PT system	Commuter plan Sapienza: 550 potential users+2279 still using PT system commuter plan TIM: 140 potential users+112 still using PT system	Total average users 41.805 (2,7% of total participants) 15772 vkm covered (ex post value)

N/A= data not available; No= no variation foreseen; T.B.C.= To Be Completed
* Data provided by local partners; ** ITEMS Data or elaborated from ITEMS Results

Table 1: ex-ante and ex-post measure indicators

From a study elaborated by ATAC together with transport operators and from surveys, it was possible to assess that about 1.400 persons used the service every day, so they are transit sharers in the modal split. The number of users of the new service constantly improved in the last three years, as reported in Figure 5, where the trend line showed an improvement of users per month. Indeed the users mean number in a month in first year (2002) was about 14.000, in 2003 was about 23.000 and in 2004 was about 28.000 in first six months. It is important to underline that the strong increase of users at the beginning of 2004 was due to the introduction of the regular service for University "La Sapienza" occurred at the end of 2003.

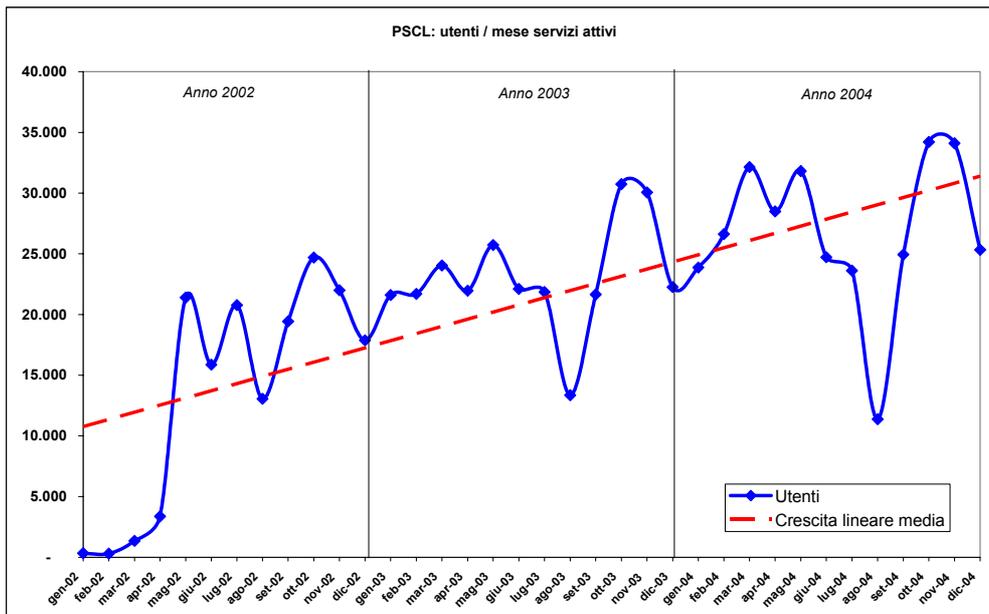


Figure 5: number of users (in blue) of the new service (2002 – 2004)

The average time for reaching the working place improved as well, diminishing by 10-20 minutes, depending on

MEASURE-LEVEL RESULTS

Measure title: Mobility Management Measures

Project: Miracles

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City: Roma

origins/destinations, in average.

Society

Unfortunately, interviewees did not provide sound replies to build a sample, so it was not possible to assess any satisfaction rate; however the increased numbers of users surely relies on a bigger and bigger appreciation of the service.

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase nominations of Mobility Manager by 15%;	25% nominations more		☺☺☺
2) increase Public awareness and support for sustainable mobility by 25%	Participants increased from 2,391 units in 2002 to 41,805 in 2005	<i>Surveys responses did not allow to have a sample of the people perception of the measure</i>	☹
3) Contribute to Increase modal shift from private cars to collective means by 5% in the Laboratory Area;	Although results are good in it difficult to assess at city/laboratory level		☺
3) Contribute to Reduce car traffic by 3% in the LTZ.	Has provided support to WP5 and 6, which have been the principal providers of results on traffic.		☺☺☺
Increase collective vehicle occupancy by 20%;			
<i>Caption</i>			
☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level			
☹ difficult to assess ☹ not achieved			

Status of the Measure beyond MIRACLES

The measure is currently operative. Results will be discussed at Municipal / national level after MIRACLES and the measure will be modified according to decisions that will be taken.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Main problem to overcome for implementation of this measure is to convince potential users to leave home private car and using provided service.

M13: Interrelationships with other measures

The Home to work shift plans are linked to PT and in most of the projects intermodality between PT and private collective transport is a pre-requisite.

Intermodality between Home to work shift plans and other forms of sustainable transport is missing excepted for taxi bus service.

M14: Lessons learned

The best way to implement this measure it is to support it by incentives and through limitation in using of private cars (e.g. pay for parking).

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17. Measure 11.1.1 – Bus ticket via sms (PagoBit)

MEASURE-LEVEL RESULTS	
Measure title : Improved multi-modal traveller services – ticket via sms	Project: MIRACLES
Measure number: 11.1.1	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>The general objectives are:</p> <ul style="list-style-type: none"> • To improve the multi-modal shift of citizen and tourists towards PT; • To improve the access to the mobility information via new media and mobile devices; • To improve the number of the occasional PT users, decreasing the maintenance costs of the stamping machines; • To enhance flexible transport services; <p>The objective of this task is to support the large scale implementation of an added value service, the payment of the PT ticket by sms using the mobile</p>	
M2: Measure description:	
<p>The measure consists in a preliminary feasibility study for the implementation of the system, analysing technical and mainly financial and legal constraints that are specific to Italy (in comparison to the other countries involved in the Telepay EU project like Germany, Finland, France).</p> <p>After the validation of the feasibility study, the implementation phase of a large scale pilot to follow.</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>The innovative feature of this new ticketing system lies in the possibility to create a totally “virtual” ticketing system using the mobile phone as main device.</p> <p>From the user point of view, the benefit of using the mobile phone as a tool to access the public transport network is highly enhanced by the highly widespread usage of mobile phones in everyday’s life. The user can indeed use its mobile phone to purchase, pay and use the “virtual” ticket, anywhere and anytime, without constraints of looking for ticket kiosks or coins for vending machines.</p>	
M4: Situation before CIVITAS:	
<p>Before the MIRACLES Project no such a system was implemented. Ticketing system was based on contact-less cards (for subscribers) and on magnetic tickets for single rides-users. Tickets distribution was based on traditional channels: kiosks and vending machines inside the stations and some relevant places.</p>	
M5: Design of the measure:	
<p>The design of this measure takes the benefit of the results obtained by the TELEPAY IST research project. The implementation within Miracles project concerns a preliminary feasibility study for the implementation of the “TELEPAY system” (sms-based ticketing system). The feasibility study has been carried out involving several departments within ATAC (Marketing, IT System, Legal, Financial departments) and several external partners (mobile telecom operators, service providers), to analyse technical and mainly financial and legal constraints for this kind of system that are specific to Italy (in comparison to the other countries involved in the Telepay project – i.e. Germany, Finland, France).</p> <p>After the validation of the feasibility study, it was carried out a more in-depth analysis of the technical framework of the system.</p>	
M6: Actual implementation:	
<p>The implementation plan of the measure can be defined as a number of mainly sequential stages (tasks), which main steps were:</p> <p>Step 1 . Evaluation of Telepay project outcomes:</p> <p>After the end of the Telepay project, a number of critical issues derived by both study and experience carried out on site (Rome) have been reviewed and in particular:</p> <ul style="list-style-type: none"> - legal issues and constraints; - customer experience (in a multi-operator framework); 	

MEASURE-LEVEL RESULTS

Measure title: : Improved multi-modal traveller services – ticket via sms

Project: MIRACLES

Measure number: 11.1.1

City: Rome

- evaluation of the demonstration phase;

Main legal constrain has been identified under the payment area. It is in fact not allowed in Italy to charge a mobile phone bill or a pre-paid phone sim-card for items different from “phone call traffic”. Therefore it has been decided to use different payment means for paying the sms-tickets (“pre-paid” or debit card, credit cards, e-wallets).

Nonetheless, overall customer experience has been highly positive. Main results are shown in the table below.

Furthermore results from users’ questionnaires analysis have been encouraging towards implementation of the system. Main results are listed below.

<i>Indicator</i>	<i>Rome</i>
Service Provision	
User Satisfaction	95%
Main advantages	Saving time 24h and everywhere availability
Need to improve service	53% Global system speed
Technical Performance	
Capacity	10 tickets / min
Reliability	Very high
Average Transaction Time	30 sec
Market Projection	
% of users ready to recommend TELEPAY	97%
Readiness to pay	
Same price	67%
Same price + SMS	10%
Commercial Service	Fully ready
Key Market	Occasional users

Table1 - results from users’ questionnaires analysis

Step 2 . Analysis of Users’ requirements, with reference to:

- End user needs;
- Company needs;

The outcomes are detailed below:

Main Issues	ROME
Interest in the implementation of a mobile ticketing system	92.4%
Satisfaction about trial	97%
Willingness to increase public transport usage with the availability of mobile ticketing system	62.1%

Both end-user and company needs have been reviewed taking into account the experience gained within the Telepay project trial and the updated information available on mobile value-added services.

From the **company point of view** and for the general use of a mobile-ticketing system the following general requirements shall apply:

- a) the need to develop mechanisms ensuring that the standards process is fully open, transparent, accessible and accountable in its decision-making.
- b) the necessity for standards processes to have adequate and meaningful consumer participation.
- c) the work needs to be done to ensure that jurisdictional conformity assessment is adequate to protect

MEASURE-LEVEL RESULTS

Measure title: : Improved multi-modal traveller services – ticket via sms
Measure number: 11.1.1

Project: MIRACLES
City: Rome

consumers.

Functional requirements to be used in system design are listed in the table below.

Function	Common requirements	Peculiarities
1) Technology	1.1) Independence from Telecom Operator	1.2.1) Use of PDA device
	1.2) Use of widespread technology allowing SMS (e.g. GSM)	
	1.3) Possibility to use forthcoming standards (e.g. GPRS, UMTS)	
2) Information	2.1) Multilanguage service information delivery	2.3.1) Provide information through WAP
	2.2) Single number to call for ticket purchase or information	
	2.3) Provide information through call centre	
	2.4) Availability of transactions data	
3) Purchase of E-ticket	3.1) Purchase by SMS	3.1.1) Purchase by WAP gate
	3.2) SMS content: ticket fare (i.e. 0,77 €)	3.1.2) Sale offers to customer by SMS. Content: bill + encryption key
		3.1.3) Purchase confirmation by SMS. Content: credit card data
4) E-Ticket content	4.1) Date & hour of purchase	
	4.2) Ticket validity period	
	4.3) Ticket service telephone number (PT operator call centre)	
	4.4.1) Customer telephone number	
4) E-Ticket content	4.4.2) According to privacy legislation customer number could be encrypted	
	4.5) Unique security code available for inspection	
5) Validation	5.1) Ticket validated through short range communication with contact less stamping machine or tollgate	5.1.1) Short range communication through bluetooth technology
	5.2) Ticket validated by purchasing time.	
6) Inspection	6.1) No extra work for inspection personnel	
	6.2) Unambiguous way of inspection (i.e. unique security code...)	
7) Security	7.1) Strong security, hacker safe.	
	7.2) No possibility to re-send the SMS containing the E-ticket.	

Table 2 - Functional requirements

Step 3 Study of legal and organisational constraints.

This study took into account the Italian specific legislation on micro-payments and telecommunication. Also the specific constraints of ATAC as public transport agency have been taken into account.

Step 4 System design:

- a. Organisational framework;
- b. System architecture;

The output of this phase was twofold: it drafted the system architecture, both on the organisational side (formal and legal relationships between actors involved) and on the technical side (information flow)

The organisational output drafted for the system can be summarized in the following diagram

MEASURE-LEVEL RESULTS

Measure title: : Improved multi-modal traveller services – ticket via sms
Measure number: 11.1.1

Project: MIRACLES
City: Rome

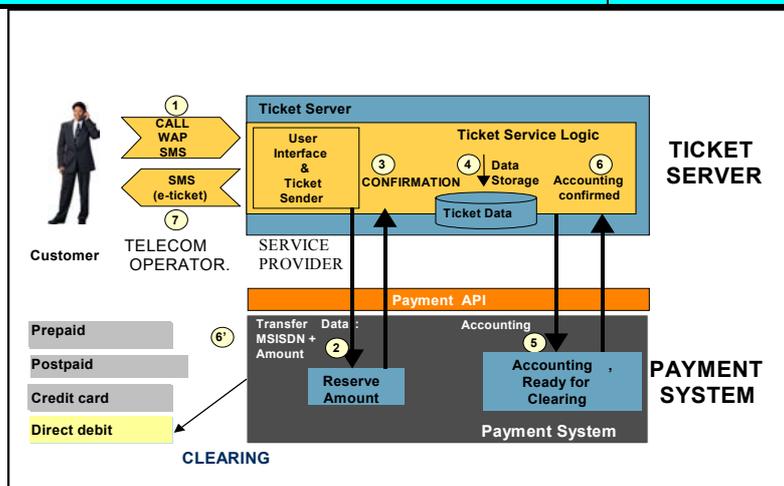


Figure 3 – Implementative aspects

A short technical test was carried out for software debugging and lab system verification.

Step 6 System verification (pilot tests) on-site.

This task was fully carried out on-site and consisted of a full system verification as a real usage simulation (a sample of people was selected for internal simulation).

Step 7 System launch and demonstration.

Once the pilot test was passed, the system was launched with a new press conference held by the Mayor of Rome on the 16th September 2005, and advertised through and ad-hoc campaign.

M7: Deviations from the plan:

There was a delay in the implementation phase due to long-lasting negotiations with mobile telecom providers and payment system providers, in achieving a coherent system providing a unique customer experience to clients. The system was announced, according to the new plan, on February 2005. Furthermore there was a slight delay in launching the operational phase of the pilot, due to commercial and technical reasons. It took more time than expected in fact to get a short phone number (i.e. 48299) unique for all the mobile telephone operators. Furthermore some slight changes had to be made on the interface between ATAC and the mobile operators to harmonise the inspection procedures. In the end, for marketing reasons, it was decided to launch the system after summer period.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable. For measures 11.1 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: not relevant, no infrastructures have changed
- *Cost for maintenance*: removed because the data is insignificant, are included in the general contract.

Evaluation category: *Society*

- *Expectations toward involved bodies, Use motivation*: removed because the interviewees did not provide a relevant number of replies to build a consistent sample

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

A specific survey has been carried out, as detailed in the M6 section, after the trial phase, in order to assess the user group perception on the service proposed.

A database recording the sold tickets.

MEASURE-LEVEL RESULTS

Measure title : Improved multi-modal traveller services – ticket via sms

Project: MIRACLES

Measure number: 11.1.1

City: Rome

M9: Achievement of quantifiable targets:

The system was implemented.
3 mobile phones operators supported the service.
A good level of acceptance and awareness has been recorder.

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; although it is too early to compare the results so far obtained with the evaluation milestones.

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

The measure goal was to improve the access to the mobility information via mobile devices and to increase the number of sold tickets via telematic devices. The goal was fully achieved, since about 300 tickets were sold on a daily basis via mobile phones (vs 41 tickets sold during the baseline trial), as reported in Table 1.

Moreover, customer care data showed that the user satisfaction rate for the service was 95%, and 97% of users would recommend TELEPAY. Its main advantages were based on time-savings and 24h-availability. (It should be reminded that the system average transaction time was about 30 seconds, with a capacity of 10 tickets/min).

Baseline and Ex-post economy indicators values couldn't be compared because values of the former were referred to a trial periods of three months with high cost of investment and low number of tickets sold. In the ex-post situation the investment cost was lower because part of such cost was spent during the trial period and sold tickets were much more than in the trial period.

Summary WP 11.1: on – line multi modal information							
Indicator (units)	Baseline	Do-nothing (2006)		Miracles scenario	Ex-post	Note	
		Frozen	Trend				
R11.1/Econ 3a Investment cost (€).	30000*	No	No	N/A	10.000 €/year	*trial lasted three months.	
W11.1/Econ 4a cost for operating (€, Trial)	370*	No	No	N/A	30.000€	*trial lasted three months 0,1 € each sold ticket.	
R11.1/Soc 1 a Awareness (%)	N/A	N/A	N/A	N/A	41		
R11.1/Soc.2.a Satisfaction level	N/A	N/A	N/A	N/A	3.72 95-97% of users recommended it	(Likert 1-5)	
R11.1/Soc.5.a N. of e-ticket sold through SMS service (telepay)	3700* Esteemed average: 41 tickets/day				300 tickets/day	*trial lasted 3 months	

N/A= data not available; No= no variation foreseen

Table 1: ex-ante and ex-post measure indicators

MEASURE-LEVEL RESULTS

Measure title: : Improved multi-modal traveller services – ticket via sms
Measure number: 11.1.1

Project: MIRACLES
City: Rome

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase the number of PT tickets sold by 1%	The number of PT single tickets sold (BIT) from 2002 until 2005 passed from 95.446.000 to 98.991.000	<i>Pagobit contributed to achieving the general objective: 300 tickets sold per day through the PagoBIT system.</i>	☺☺☺
2) Increase public awareness and support by 10%	More than 95% of users recommend the use of PagoBit		☺☺

Caption

☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level
 ☺ difficult to assess ☺ not achieved

Status of the Measure beyond MIRACLES

The measure is currently operative. Results will be discussed at Municipal / national level after MIRACLES and the measure will be modified according to decisions that will be taken.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Main drivers for implementation can be divided into two main areas: customer experience and harmonisation with company's operational procedures on ticketing system.

On the former area it is straightforward to provide a user friendly system. The user shall be able to get the ticket through a unique experience, regardless the mobile operator and payment provider he has subscribed.

On the latter area the company shall harmonise the new ticketing system within its procedures.

Possible barriers came out on one side from the legal framework and on the other side from lacking of standards. The legal framework indeed made impossible to bill the ticket directly into the phone bill; this requested the need for customers to choose a payment mean among a list of possible means (debit cards, e-wallets, credit cards). This prevent to use the easiest way to pay the ticket, therefore preventing a full exploitation of the market and affecting the deployment of adequate investments on the system, with the risk of starting a vicious circle that could also compromise the achievement of a reasonable number of tickets sold to get the brake even point.

The lacking of standards in accessing the mobile phone infrastructures made almost impossible to build a single platform with a sustainable investment. Therefore it was needed to dialogue with each operator in a slight different manner, postponing the integration of information at a seconds stage.

M13: Interrelationships with other measures

The ticketing system has strong interrelations with the provision of information via mobile devices, as developed in measure 11.1. It will be in fact now possible to use the mobile phone both to get the information on public transport network and by the electronic ticket anytime, anywhere.

M14: Lessons learned

Need to have open single European markets on e-payment, mobile phone communications and to lower legal and financial barriers on micro-payment to exploit new promising markets and to study and implement new services for citizens.

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18. Measure 11.1.2 - Information via mobile devices

MEASURE-LEVEL RESULTS	
Measure title: Improved Multi-modal travellers' services s	Project: MIRACLES
Measure number: 11.1.2	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>The general objectives are:</p> <ul style="list-style-type: none"> • To improve the multi-modal shift of citizen and tourists towards PT; • To improve the access to the mobility information via new media and mobile devices; • To improve the number of the occasional PT users; • To enhance flexible transport services; <p>The <u>operative objectives</u> of this task have been:</p> <ul style="list-style-type: none"> • to enhance the access to information on mobility-related issues through mobile devices • to integrate information on tourism and PT on a common platform; • to improve the information provided via web through the INFOPOINT [ref. task 7.2.1] and to experiment mobile devices to distribute the INFOPOINT information on PT. 	
M2: Measure description:	
<p>On one side it was decided to continue the trial of the integrated tourism-transport information as developed within Capitals ITTS project, as a first sample of integration; on the other side it was decided to deliver information through new portable devices (mobile phones, PDA, etc...), to cover users "on the move"</p> <p>Thus special care has been drawn to the development of on-trip information, based on the ATAC Infopoint, with particular reference to the attractiveness of destination and interchanges in PT services, provided "on-line".</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>By implementing an on-line, wireless, multimodal, multi-lingual information system, PT services are quickly identifiable and the user can easily combine and integrate them for personalised journey planning. The integration of web technologies and increased PT services supply aims to provide added value to public transport services. Further the technological solution are tailored on Roman PT customers' needs and cultural behaviours. The commitment of Atac S.p.A. in supplying "user friendly" tools for journey strategy, in this case is addressed to non-systematic users. It has been planned to extend the information on multi-modality already available, according to the following items:</p> <ul style="list-style-type: none"> ○ New multilingual website and kiosks, to provide PRE TRIP information, to allow booking and multimodal ticketing to a large target of users; ○ The "push/pull" systems to supply mobility information through portable devices in order to enlarge the set of tools for users in their "trip planning": ○ the Infopoint through WAP/PDA and ○ the Prototype of Infopoint through SMS/MMS. <p>Implementations have been performed taking advantage of the following devices:</p> <ul style="list-style-type: none"> ○ <u>Mobile phones</u> (sms/mms, WAP/UMTS) and <u>Kiosks</u> and to extend the multilingual web site specifically for the Infopoint information. 	
M4: Situation before CIVITAS:	
<p>Before the MIRACLES Project Public Transport Information was provided only by ATAC web site only in Italian. Traffic information was not provided on the web and tourist information was not integrated within the mobility information.</p>	
M5: Design of the measure:	
<p>The interface for mobile devices was developed upon the XML interface for the itinerary calculation engine developed within Capitals ITTS that allowed integration of Public Transport and mobility information within any system and interface.</p> <p>Therefore the XML interface was reviewed and updated in relation to Infopoint updating. Then mobile interface user requirements were defined.</p> <p>A selection of possible providers was carried out and the development was awarded to a company, specialised in mobile interfaces.</p> <p>Main features requested for the mobile InfoPoint platform were:</p> <ul style="list-style-type: none"> - multi language information (Italian, English, Spanish, French and German); 	

MEASURE-LEVEL RESULTS

Measure title: Improved Multi-modal travellers' services s

Project: MIRACLES

Measure number: 11.1.2

City: Roma

- multi channel access (WAP, i-mode, XHTML)
- multi device access (information customised for each devices – layout and dimension).

The solution adopted, was to build the most general platform able to adapt dynamically to each device and to get "run-time" the right format.

The platform, based on open source software, is used to deliver following information:

- find address;
- itinerary calculation;
- latest news (only in Italian, since they are edited from the press office in Italian; the service is anyway ready for the extension to all the other languages);

search for closest service (only in Italian, since they are edited from the press office in Italian; the service is anyway ready for the extension to all the other languages).

How the system works:

Once that the URL <http://infopoint.atac.roma.it/wap/> has been typed on the mobile phone, the access to ATAC WAP service is immediate and automatic: the system will recognize the device and will adapt the information provided to the specific device.

The command basic navigation functions contained in all the windows displayed are:

- Main Menu: to come back to the main menu;
- Home: to come back to the first page;
- Back: to go to the previous page.

The interface has been designed to be as much as possible simple and light to be downloaded by the mobile device the "Home Page" gives directly the option to choose the preferred language, as shown in the next figure:

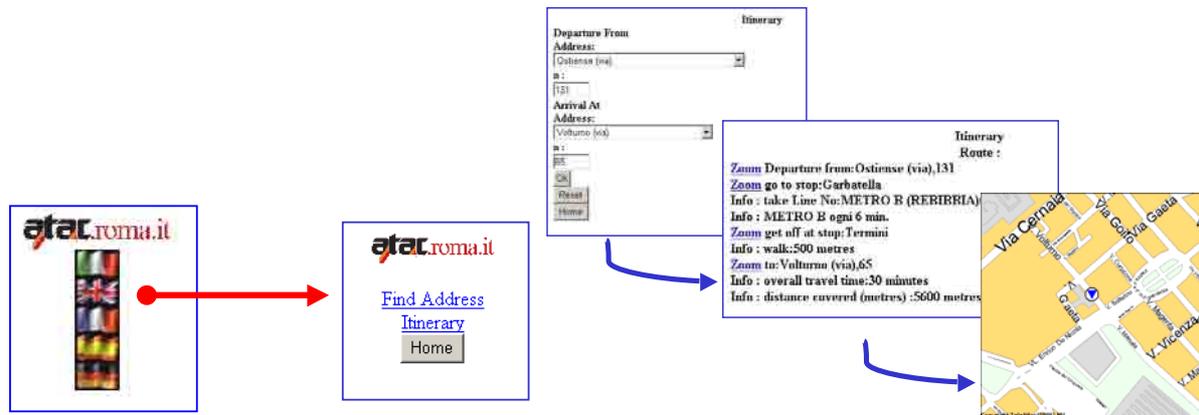


Figure 2 – choice of the language

Then, the user can select from two option as shown in the picture above:

- search address
- Itinerary calculation between requested origin and destination by Public Transport

Afterwards, he can access the services, designed to allow to the user a internet-like customer experience. Indeed the information is presented in a compact way and further requests can be asked by the user. To give an example, the user asks for an itinerary, fill in address and destination, and then he gets firstly the most relevant information: the directions; then he can ask for single maps on the interested section (zoom).

Thanks to the platform developed both the sms/mms and the WAP/GPRS services have been made available with a the user friendly interface has been developed too.

The information, supplied via SMS/MMS, is based on the Data Base specially compiled for the Atac Website. The design phase has also included a large software reengineering and implementation which has been described in the detail within the Implementation Report n°1 (chapter 3.1 – WP11)

MEASURE-LEVEL RESULTS

Measure title: Improved Multi-modal travellers' services s

Project: MIRACLES

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City: Roma



Figure 1- the sms/mms Infopoint" friendly "interface

Also for what concerns the kiosks, during the design phase a specific interface has been developed to display data from the Infopoint.



Figure 2 – The Infopoint interface for the kiosks

M6: Actual Implementation:

Information through mobile devices

Nowadays the information on mobility can be accessed through the mobile devices commonly used, mobile phones and PDA.

Within MIRACLES the INFOPOINT has in fact been demonstrated to provide information both via sms/mms and via WAP/GPRS.

1) In order to perform the trial of the **sms/mms** service, a sample of users has been recruited via internet in September 2003, through the completion of a questionnaire on the ATAC web site. As soon as the trial started, a discussion forum was established for the users. This interaction has helped to improve the service. The sms/mms experimentation was successfully concluded in March 2004.

As a matter of fact the final implementation of the service is not an objective of the MIRACLES project, since it will be performed when the AVM system will have been completed over the whole city PT network and a complete set of real time information will be provided.

2) On the other hand, following a first trial held on ATAC site, information can also be accessed by mobile phones endowed with the **WAP** service.

After the first phase the WAP GPRS service has been further developed and improved eg with colour interface, so that ATAC has been pointed out on the WURFL web site (<http://wurfl.sourceforge.net/links.php>) for being the first PT company to use multi serve maps to mobile users.

This service is now fully in operation

The multilingual website and kiosks:

In order to extend information to a larger user target the Infopoint <http://www.atac.roma.it/infopoint> has been updated to provide information in different languages.

Available languages are now: French, Spanish, English and Italian

MEASURE-LEVEL RESULTS

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City: Roma

The screenshot shows the website interface for atac.roma.it, titled 'il portale della mobilità'. It features a navigation menu with buttons for 'biglietti e abbonamenti', 'orari e percorsi', 'vantaggi e promozioni', and 'gare e contratti'. Below the navigation, there are sections for 'MUOVERSI A ROMA' with flags for UK, France, Germany, and Spain, and 'WAP'. The main content area includes a search form with fields for 'PARTENZA' (departure) and 'ARRIVO' (arrival), both with 'N°' and 'vai' buttons. There are also sections for 'TROVALINEA' (find line) and 'TROVAINDIRIZZO' (find address), each with a 'vai' button. On the right side, there are sections for 'ULTIM'ORA' (last news) with 'Lavori sui binari' and 'LA GIORNATA' (today's news) with 'Tre chilometri di violazioni' and '11 nov - In un'ora trecento violazioni, in'.

Figure 3 - Interface for the Infopoint multilingual web site

The multi-lingual service is based on five main actions:

- o Find address;
- o Route calculation;
- o Tourist lines;
- o Resource on map;
- o Resource list.

In addition to the multilingual website delivery of telematic travel information to citizens and tourists has been extended through the installation of 5 experimental public kiosks.

Five suitable locations spread on the territory have been identified and the kiosks are still running, the experiment has become a consolidated experience.

M7: Deviations from the plan:

The measure described in the present template was not included in the first version on the MIRACLES Technical annex. Nevertheless the IT department of ATAC had started working on it at the beginning of 2003 with the idea of including the wireless experimentation within the CIVITAS framework.

The gantt presented in the amendment has been respected in all of its steps. And the measure has been completed according to the steps described, without any deviations.

Although the kiosk should have been experimented just for six months ATAC has decided to buy them and to make the experiment become a final implementation.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable. For measures 11.1 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Cost for changes of infrastructure per inh.*: not relevant, no infrastructures have changed
- *Cost for maintenance*: removed because the data is insignificant, being part of a general maintenance contract.
- *Income*: substituted with investment

Evaluation category: *Society*

- *Expectations towards involved bodies, Use motivation*: removed because the interviewees did not provide a relevant number of replies to build a consistent sample
- *Type and no. of provisions for disabled people*: moved to measure 7.2.1 because more suitable to describe it.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

The performances of each section of ATAC web site is constantly monitored and monthly reports are internally circulated. Thus the main source of information is actually this internal reporting which is based on the logs to the web.

MEASURE-LEVEL RESULTS

Measure title: Improved Multi-modal travellers' services s

Project: MIRACLES

Measure number: 11.1.2

City: Roma

M9: Achievement of quantifiable targets:

1) The original target was to increase the number of visits to ATAC web site by 3.000 per month.

Actually the increase of visits to ATAC web site from 2002 until 2005 is of the 197%, the average of visitors has been of 204.000 in 2005.

Here follows a summary table showing all the average data collected on the site:

MEDIE	2001	2002	2003	2004	2005	2006
Contacts	3.339.626	7.113.545	14.828.212	23.473.238	32.122.342	24.484.004
Impressions	34.135	1.993.820	2.943.470	4.142.345	5.797.876	6.342.618
Visits	9.819	68.646	102.823	147.468	204.312	147.519

The data on 2006 is partial because referred only to the first 6 months.

A considerable change in the trend of use of the web site can be noticed in 2004, when the visits have almost doubled compared to 2003.

2) Since the wireless system has been implemented nowadays 10.000 queries per month are performed by the "mobile/wireless users".

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; in particular

- 1 – Delivery of mobility information through wap - Achieved
- 2 – Delivery of mobility information through sms – Achieved

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

Being this measure strictly linked with measure 7.2.1 (see the related template for main results), it is here worthwhile just remembering the positive impacts on how people perceived this new service. It is worth remembering the number of people accessing the INFOPOINT web pages increased by 30%, and this goes in hand with the 10,000 queries per month. Together, these indicated the success of the measure

This aspect went in hand with the general public perception of telematics which was very encouraging. All these outcomes are synthesized in Table 1.

Summary WMP 11.1.3 PT Information								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R7.2/Soc.4.a R11.1.3/Soc1.a		Availability of information via internet (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles Since June 2002
R11.1.3/Soc1.b		Provision for tourist (no. per type)	none	No variations foreseen for frozen and trend scenarios			A multilingual website 5 kiosks	
R11.1.3/Soc1.c		Visitors on web site for information (n.)					10.000 queries/month	

Table 1: ex-ante and ex-post measure indicators

MEASURE-LEVEL RESULTS

Measure title: Improved Multi-modal travellers' services s

Project: MIRACLES

Measure number: 11.1.2

City: Roma

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase the number the number of visits to ATAC gateway by 3.000 per month;	10,000 queries per month		😊😊😊
<p><i>Caption</i> 😊😊😊 achieved far beyond forecasts; 😊😊 not fully achieved but still satisfactory outcome; 😊 achieved at a minor level 😊 difficult to assess 😊 not achieved</p>			

Status of the Measure beyond MIRACLES - The measure is currently in operation.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

For the delivery of information through new media the main driver was to design an open platform, capable of usign all the different communication protocols used in the mobile communication market. Futhermore a great effort was put on designing a platform capable of delivering the information (texts and maps) according to the graphic functionalities of each tool. This allows to provide the most friendly information to users.

For the integration of information two kind of problems can be envisaged: the technical needs and the organisational needs.

Concerning the first issue, it was very important to use open standards to build communication interfaces. This permitted to leave the different database (both property and management) to respective owners.

With respect to the organisational issues the main problem is the agreement among different organisations on sharing information. The possibility to maintain the Capitals ITTS platform was very useful to demonstrate physically to decision-makers all those functionalities and benefits for users to access an integrated information.

M13: Interrelationships with other measures

Task 7.2 – Multi modal information; Task 7.3 – new lines; Task 11.2.2 – AVM on the PT network

M14: Lessons learned

It is indeed still very difficult to build a sustainable business model on information systems for public services; this may prevent investment on the information filed. It was therefore very important the possibility to relay upon data on public transport information demand, gathered both mainly from ATAC web site and from Capitals ITTS platform experience to design the new systems.

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19. Measure 11.2.1 – AVM features

MEASURE-LEVEL RESULTS	
Measure title: Improved network management - Information	Project: Miracles
Measure number: 11.2.1	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<ul style="list-style-type: none"> • To implement ITS management system features on the 60 Express bus line • To implement ITS management system features on the n°8 tramway line (Octoplus) ; 	
M2: Measure description:	
<p>1. At the outset the AVM system in Rome has been designed just with the purpose of monitoring and check the level of service provided by the different PT operators, in accordance with the “service contracts”.</p> <p>As a by-product, and within the Miracles project, the AVM project aims also to provide the passengers standing at bus stops, with a wide range of integrated information. Within Miracles, the aim is therefore to distribute such information alongside the newly created “express bus” line n.60, passing trough the project laboratory area. This is performed through the installation of new electronic bus stop signs, allowing to display dynamic information.</p> <p>2. OCTOPLUS is a project based on telematic open architecture, implemented on both PT and traffic.</p> <p>The system, implemented on Line 8 – from Casaletto to Argentina- is based on a control and monitoring system integrated with a pre-existent traffic light control;</p>	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
<p>Distribution of dynamic information at the bus stop via electronic bus stop signs, as a by-product of an AVM system designed only for monitoring purposes.</p> <p>The second innovative aspect is given from the “open” architecture of the system, that ensure the independence of the implementation and of development by suppliers; and the large use of the telematic to manage interaction between traffic flow and PT service.</p>	
M4: Situation before CIVITAS:	
<p>Before the MIRACLES Project started, no AVM system was implemented in Rome, neither any dynamic information was provided to users over any line or segment of public transport network.</p>	
M5: Design of the measure:	
<p>1. (bus) - The design of this measure has been carried according to the following steps:</p> <ul style="list-style-type: none"> - Definition of the team of project managers appointed for the different aspects; - Infrastructures building and set-up (main effort was put on the installation of the OBU on the major part of the fleet); - Software design and programming (concerning PT information, there was no software developed). The software had to be designed and refined to use data derived from the monitoring system; furthermore a broadcast message was designed, including: approaching of next bus, indicating both time and number of stops, closest ticket kiosk, possible alerts and news. - Poles installation (the planned 48 electronic bus signs have been installed in the city center serving main lines or junction. The express line n.60 was selected for the public transport information trial); - System testing (test were carried out on the communication network (GPRS) and on the management of bus stop from remote). <p>Start of experimental stage (the first results of the trial led to the decision of the Municipality to go for installation of 250 more electronic bus stop signs).</p> <p>2. (octoplus) - The implementation of the centralised automatic micro-regulation system for the n°8 tramway line has been carried out through the following steps:</p> <ol style="list-style-type: none"> 1. Specification of requirements 2. Implementation of: <ul style="list-style-type: none"> • On-board equipment; • Control Centre that performs the monitoring, the automatic micro-regulation, the real-time control, 3. System installation; 4. On-site data collection; 5. Final testing of the system; 6. System implementation. 	

MEASURE-LEVEL RESULTS

Measure title: Improved network management - Information

Project: Miracles

Measure number: 11.2.1

City: Roma

M6: Actual implementation:

1. The implementation on the "express bus" line n.60 has been completed according to the schedule, on December 22nd 2004:

- Tests have been carried out on the OBUs (On Board Units) and on the electronic poles.
 - All the buses have been equipped with the OBUs;
 - the electronic poles have been implemented, providing information on the buses approaching;
 - All the 12 depots have been wired, to allow the collection of the information daily stored on the OBUs.
- Although the AVM system was designed for monitoring purpose only, a control centre has been set up.

2. The implementation plan of OCTOPLUS has been based on a number of mainly sequential stages, whose main steps are:

a) Bus Stop equipment

- (DSRC) - a short-range channel, to support the communication with vehicles;
- The GPS/GPRS system, that allows communication with the pole.

b) On-board equipment

The on-board equipment, AVL, is based on the following components, that are connected to each-other :

- On-Board computer with display;
- Protected Toolbox for GPRS communication;
- Antennas;
- Toolbox for odometric signals conditioning;
- Toolbox for emergency signals capture;

c) SPOT controllers

The PT user information, generated by AVM, is sent to the competent SPOT, which re-transmit signals to the stop equipment, via DECT.

d) Implementation of AVM system - The AVM system is managed by a control room equipped with Server, Router, Modem.

M7: Deviations from the plan:

No deviation occurred from the original implementation plan, as provided in the amendment. Anyway, compared to the initial objectives, as stated in 2002, the large scale implementation of the AVM was not envisaged.

No infrastructural indicators have been defined for this measure, exactly because of the initial uncertainty on the targets.

The AVM was at that time considered just in a trial form.

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

The AVM system itself is a tool to measure performances of the service levels.

Anyway the most interesting would have been the analysis of the perception of public, this was not possible due to the late large scale implementation of the system.

M9: Achievement of quantifiable targets:

- 50 trams have been equipped with 100 OBUs.
- 189 bus lines are now monitored,
- 2.572 buses are equipped with the OBU and can be monitored.
- 12 depots have been wired.

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; in particular the implementations went beyond the initial plans.

M11: Report on the measure results:

The results concerning the implementation of AVL/AVM features in Rome has gone far behind the expected results. Actually a large scale implementation has been achieved Rome together with London has the largest number of electronic poles implemented.

Results can be assessed under the qualitative point of view. Besides the improved quality of information already stated (see also measure template 7.2.2), which allowed passengers waiting for the bus to know how long they

MEASURE-LEVEL RESULTS

Measure title: Improved network management - Information

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Measure number: 11.2.1

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have to wait before boarding, for the next two approaching buses of the same line, it is important to stress the role of telematics and the need of time for implementation. In this case, the implementation of telematics devices required a long period of application (and on a vaster range); thus assessable results can be obtained only after switching from the role of one-off measure. However, the measure for the trial period of implementation proved to operate well and the system is reliable.

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
Contribute to 1) Increase the number of PT tickets sold by 1%	The number of PT single tickets sold (BIT) from 2002 until 2005 passed from 95.446.000 to 98.991.000		
Contribute to 2) Increase public awareness and support by 10% 3) Reduce peak hours car traffic by 3%; 4) Reduce transport related emissions by 5%; 5) Increase walking by 5%; 6) Increase modal shift from private cars to collective transport by 5%; 7) Increase collective vehicle occupancy by 20%	The measure has partly contributed and provided support to all the targets that have been achieved		
<i>Caption</i> 😊😊😊 achieved far beyond forecasts; 😊😊 not fully achieved but still satisfactory outcome; 😊 achieved at a minor level 😐 difficult to assess ☹️ not achieved			

Status of the Measure beyond MIRACLES

The measure is currently operative and will continue beyond MIRACLES, within April 2006 the number of Poles installed have reached 300.

20. Measure 11.2.2 - Environment

MEASURE-LEVEL RESULTS	
Measure title: Integration of Transport Management Systems (WP 11)	Project: MIRACLES
Measure number: 11.2.2 – Traffic and environmental analysis of TDMS	City: Rome
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
<p>Air pollution caused by road traffic is an important problem in almost all our big and medium size towns and the reduction of transport-related environmental impacts at the local level is among the main goals of the Miracles project. For this purpose it is crucial to acquire a good knowledge of the air quality in the Laboratory Area as well as of the effects on the air pollution of the planned measures.</p> <p>The aim of this measure is to develop a system able to evaluate the benefits related to the adoption of traffic demand measures and available for all the subjects involved in the city mobility system, that are the Transport and Environmental departments of the City of Rome and ATAC S.p.A. In details, the measure objective is to extend the coverage and functionalities of the Traffic Control Centre of Rome Municipality and to improve the systems methodologies in use to assess the environmental impacts of the on-line/off-line traffic scenarios under study, through the following two approaches performed by the partners ATAC/ATAC and ENEA</p> <p>1) The first aim of this measure is:</p> <ul style="list-style-type: none"> ○ to develop a system (TDMS) able to evaluate the benefits related to the adoption of traffic demand measures and available for all the subjects involved in the city mobility system, ○ to acquire a good knowledge of the air quality in the Laboratory Area as well as of the effects on the air pollution of the planned measures. ○ to extend the coverage and functionalities of the Traffic Control Centre of Rome Municipality and to implement a system for the environmental control and scenario analysis. <p>2) The second objectives of the additional activities performed by ENEA are:</p> <ul style="list-style-type: none"> ○ to collect additional data on the driving patterns and on the relevant speed profiles along specific typical routes, as needed to allow the use of a dynamic emission model (i.e.:TEE dynamic option), instead of a ATACtic one based on the average speed only; ○ to acquire additional information about the local concentration levels of the more critical air pollutant (i.e.: the smaller fractions of the particulate matter, PM10, PM2.5 and PM1.0, which are now considered the most harmful and dangerous air pollutant for human health) in some critical locations within the Miracles laboratory area; 	
M2: Measure description:	
<p>1) In this Task, environmental analysis of Traffic Demand Management Strategies (TDMS) with mapping of the air pollutant concentration levels, as necessary for the scenario analysis and for evaluation purposes, is performed by ATAC by means of an information technology system including simulation models, traffic-emission-dispersion model. This task expects to produce:</p> <ul style="list-style-type: none"> ❖ Step 1: Reconstruction and description of real-time traffic flows (5') and speed on the primary network for the whole Miracles Laboratory Area; ❖ Step 2: near real time description of traffic, pollutant emission and pollutant concentrations with grid maps on the Laboratory Area. An hourly description of emissions and concentrations of CO, Benzene and PM will be provided on the area with a detailed spatial resolution ❖ Step 3: Simulations on the expected benefits coming from MIRACLES TDMS both in transportation and environmental analysis. The scenario module has to provide the analysis of the expected benefits coming from MIRACLES TDMS on transport and environment. In fact the scenario module allows comparing traffic situation and atmospheric pollution before and post MIRACLE TDMS application allowing a quantitative analysis of impacts. <p>2) For what concerns the ENEA trial, the initial part of the project has been spent for studying, designing and planning such activities, which have been discussed and agreed between ATAC and ENEA throughout of a number of meeting; finally the design phase has been focused on the following two items:</p> <ul style="list-style-type: none"> ❖ the so called “floating car” for the measurement and the collection of traffic kinetic data needed as input data from the dynamic emission models for improving the calculation of the air pollutant emissions in the same area; ❖ a mobile system for the measurement of the Particulate Matter and of his distribution into the related three classes (PM10, PM2.5 and PM1), in order to elaborate time and space maps of this harmful pollutant along the main bus line routes inside the Laboratory Area; <p>The above mentioned devices for the measurement and the collection of traffic kinetic data have been installed on</p>	

MEASURE-LEVEL RESULTS

Measure title: Integration of Transport Management Systems (WP 11)	Project: MIRACLES
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the same mobile laboratory equipped for the particulate matter detection, which will be use as “floating car” as well. The main technical characteristics of this “floating van” are described in the following paragraph. The preparation of the above mentioned mobile on-line measuring system has been completed in the first part of the project.

The first half of the year 2004 was dedicated to the calibration of the system. The testing and demonstration of the system, has started on past October 2004 by means of a specific measurement campaign, having also the aim of evaluating the actual effect of the introduction of a new trolley line. During the period from October 2004 top January 2005, the speed profiles and PM ex-ante measurements have been performed at a specific site (Via Nomentana) selected along the route of trolley line. The ex-post measurements have been started at the begging of May 2005. Some measurements will need to be repeated on next autumn and the trial and was completed by November 2005.

The Implementation – how was the measure implemented?

M3: Innovative aspects:

The innovation of this Task should permit to implement an innovative model for real time air quality control, integrating a scenario module able to support the ex-ante evaluation of mobility strategies both in terms of mobility and environment.

The implementation of this system and mainly of the **scenario module** could allow the Municipality to perform specific analysis of Traffic Demand Management Strategies in a specific time period; before its implementation such analysis where performed on a yearly basis.

Within the system first release (HEAVEN Project), the **assignment module** was performed as a static Deterministic User Equilibrium by means of a commercial transport simulation software (*TransCAD*[®]). Now, to obtain a realistic configuration of the city’s transport system and to represent traffic flows time dependence a specific algorithm (identified by the acronym UE) has been developed by ATAC.

The UE algorithm is based on static Deterministic approach but its main characteristics is represent by a specific routine that compare results of the assignment procedure (equilibrium flows) with flows detected on monitored links (every five minutes). If differences are detected on a specific link, traffic flows on that link are settled equal to the measured flow. Thanks to this correction process the algorithm is able to determine realistic flow values on each link of the network are obtained.

Moreover, UE algorithm allow to detected traffic flow variations with a time range of five minutes; in other words, it is like disposing of a dynamic assignment model (almost real-time) thanks to whom it is possible to take care of over saturation phenomena. The EU algorithm (developed, implemented and validated by ATAC) provides very reliable traffic flow data. As result of this analysis it has been possible for ATAC to define a general “**traffic indicator**” by means of which it is now possible to assess the impact on total traffic flow of specific events (e.g. road work on main city corridor) and to assess city’s congestion level and to classify days week according to traffic indicator values. It is defined by the sum of all traffic flows circulating on the network in a specific time period.

The operator interface (**front end**) has been completely redesigned since it was initially developed as a client-server system while it is now a web-oriented front end. Moreover, the front end has been developed on an open source basis ensuring a significant reduction of the system costs both in terms of SW licenses and maintenance. Finally, maps elaborated by the system will be displayed in a specific area of ATAC web site.

Besides, for what regard ENEA trial, the innovative concept of the “floating van” was used and described here below, integrating speed profile measurement with on line measurements of the particulate matter smaller fractions (2.5 and 1.0).

M4: Situation before CIVITAS:

The Rome air quality is monitored by means of a number of fixed monitoring stations placed in 10 selectedpoints of the city, which are continuously providing measures of the main air pollutants (CO, NOx, particulate matter, ecc.), according to the environmental protection laws and rules. In addition some batch campaign have been carried for measuring the level of specific pollutants as Benzene.

The Traffic Control Centre located in ATAC, is integrating on a reference GIS graph various subsystems such as the Access Control to the LTZ (23 gates), 48 VMS, 60 TV Traffic cameras system and 400 intersections of the UTC system. The system was partially financed by EU funded project Capitals PLUS (creation of an integrated mobility services platform based on the TCC and TIC/TSC). The system already has direct information on 200 km of the primary road network in Rome.

These two systems gave the necessary data inputs to a prototypal traffic-environmental chain system was developed in a laboratory area of 16 Km2 within the EU funded project HEAVEN. This area is included in the

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Miracles Laboratory area. The HEAVEN prototype system allowed a near real time description of traffic, pollutant emission and concentration on that limited demonstration area.

M5: Design of the measure:

1) Traffic – Environmental model chain

The environmental analysis of traffic demand management strategies with mapping of the air pollutant concentration levels realised within the MIRACLES project, represents a forward step in the environmental analysis actually performed by the Municipality.

Precisely, it allows, starting from the origin-destination (O/D) matrix and the city transport network (graph), to determine pollution condition due both to normal traffic condition and to the adoption of specific Traffic Demand Management Strategies (TDMS) as access restriction to not catalysed vehicles and road closure for maintenance works. Before the implementation of this system, all the municipality pollution analysis were performed on a yearly basis within the so called “Annual report on Rome’s air quality”.

This implemented system comes by the prototype system developed by STA/ATAC S.p.A. and by the Environmental department of Rome’s Municipality during the co-funded European project HEAVEN.

The HEAVEN prototype system

The main purpose of the HEAVEN project was to create a real time description of traffic, pollutant emissions and concentrations on a demonstration area of the city of Rome. All the information were collected in a common repository accessible to professional users and decision-makers that provides support to evaluate the environmental impact of TDMS.

Besides, the HEAVEN system is a DSS (Decision Support System) whose aim is to evaluate the environmental impact of TDMS through off-line scenario analysis, to support decision makers and professional users in taking the most environmental effective policies though both the scenario analysis and the realisation of a common repository where historic data on traffic emissions and concentrations are stored.

HEAVEN architecture

“Before” the implementation of the HEAVEN system in Rome the traffic data were available only on monitored links of the Traffic Control Centre while on the rest of traffic network the only information available was represented by the traffic flows obtained through the O/D matrix assignment procedure updated every five years. On the pollution side the only data available were the one obtained by the 12 measurement stations located within the city. Moreover, emission maps were produced yearly and due to the lack of a specific tool they were affected by a large personnel factor. Next figure shows the existing system before HEAVEN implementation.

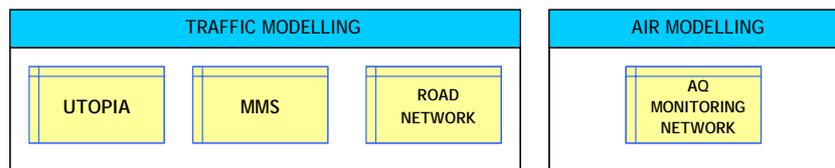


Figure 1: “Before” HEAVEN

“After” the implementation of the HEAVEN system, the total number of monitored and modelled links in the demonstration area is equal to 739, pollution concentration are calculated hourly for four different pollutants (CO, C6H6, NO2, PM10) in 4,356 points and emission and concentration maps are produced on-line. Fig 2 shows the top level DFD diagram of the Rome DSS demonstrator and identifies the main processes, data stores and data flows.

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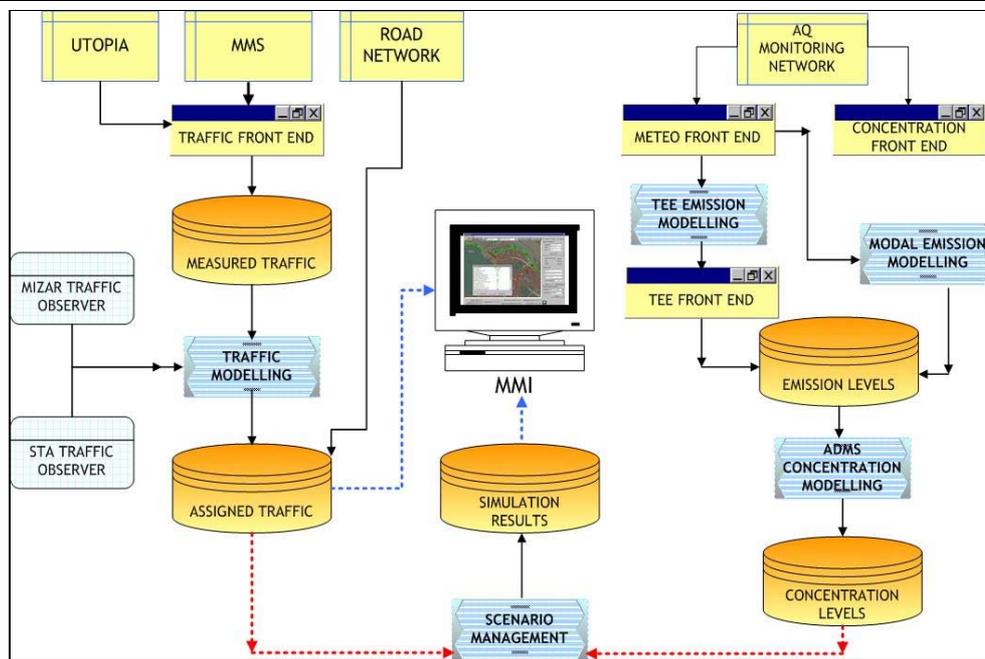


Figure 2: The system “After” HEAVEN

The general structure of the HEAVEN DSS consists of two main modules: traffic and air quality modules, the latter divided in emission module and dispersion module. The three modules exchange input and output data between them and external existing systems. All data are gathered in a common database and information is represented on a friendly and easy to use interface.

Finally, the scenario module allows an off-line analysis of the environmental impacts of specific TDMS defined by the user.

Reaching the MIRACLES architecture

The HEAVEN project can be considered as the preliminary step of the implementation of a dedicated system to assess environmental impacts due to specific TDMS.

Since then, thanks to the international co-operation established among the different European cities (e.g. Berlin, Leicester, Paris, Prague, Rome and Rotterdam) during the HEAVEN project it has been possible to use other cities experiences to identify the best way to improve the system.

Therefore, all the activities carried out by Berlin and other mayor cities resulted to be very useful in terms of identifying urban PM10 composition (see next figure) and defining the most suitable approach to calculate dispersion maps (see figure 4).

Main results of PM10 analysis are the following :

- ❖ 20% of regional PM10 background can be attributed to traffic exhaust emissions, but the bulk is secondary PM coming from industries and combustion;
- ❖ more then 50% of traffic related PM10 stems from road and tyres abrasion and resuspension of road dust;
- ❖ regional PM10 background is between 30-60% of kerbside levels;
- ❖ heavy and light duty vehicle represent one of the main pollution source

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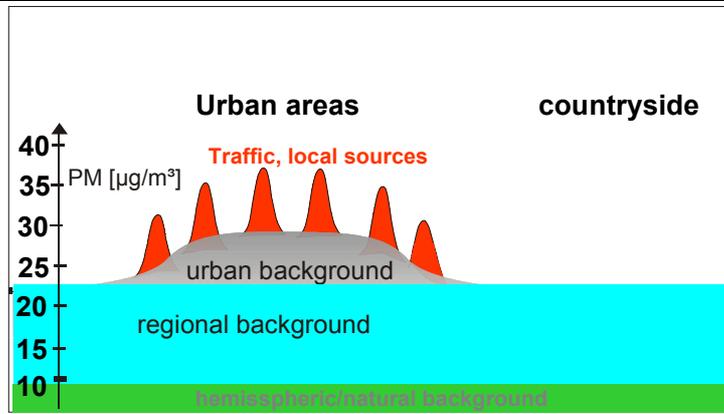


Figure 3: Contribution of PM10 emissions in Berlin

In the following figure, the new approach adopted to calculate dispersion maps is shown. This represents a very strong change, moving from a single step to a multiple steps approach where each one refers to specific institutional competencies (City, County, Region). Adopting the later approach, it should be highlighted that each upper level step (e.g. Region) provides input dispersion for the successive steps (e.g. County).

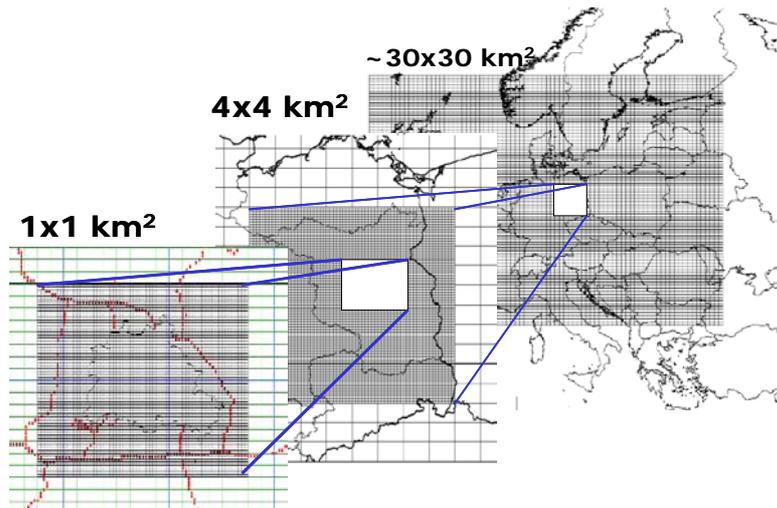


Figure 4: the nested approach in calculating pollutant dispersion

The MIRACLES prototype and SICOTRAVIA structural system

The HEAVEN prototype system has been improved and extended within the MIRACLES project. The main purpose of the project is a real time description of traffic flows, pollutant emissions and concentrations within the Laboratory Area.

All the information are collected in a common repository accessible to professional users and decision-makers that will provide support to evaluate the environmental impact of Traffic Demand Management Strategies (TDMS).

The MIRACLES system is made by the following five modules:

- A) Assignment Module
- B) Emission module
- C) Dispersion module
- D) Scenario module
- E) Operator interface

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Here after a brief description of system modules functions is reported together with brief description system's upgrade performed within the MIRACLES project. This prototype is the first step of the SICOTRAVIA project, partially financed by the Italian Environmental Ministry, that will be the implemented system, to be routinely used by the Municipality and ATAC.

A) Assignment Module

The assignment module provide the equilibrium flows distribution over the entire network; within its first release (HEVEAN Project) it was performed as a static Deterministic User Equilibrium by means of a commercial transport simulation software (*TransCAD*[®]). Now, to obtain a realistic configuration of the city's transport system and to represent traffic flows time dependence a specific algorithm (identified by the acronym UE) has been developed by ATAC.

The UE algorithm is based on static Deterministic approach but its main characteristics is represent by a specific routine that compare results of the assignment procedure (equilibrium flows) with flows detected on monitored links (every five minutes). If differences are detected on a specific link, traffic flows on that link are settled equal to the measured flow. Thanks to this correction process the algorithm is able to determine realistic flow values on each link of the network are obtained.

Moreover, UE algorithm allow to detected traffic flow variations with a time range of five minutes; in other words, it is like disposing of a dynamic assignment model (almost real-time) thanks to whom it is possible to take care of over saturation phenomena.

B) Emission module

TEE (Traffic Emissions and Energetic developed by ENEA – National research centre for energy and environment) and Modal Emissions Estimation Model are both based on COPERT Methodology (approved by EEA – European Environment Agency) with adjustments that take into account further information on duty cycles available on specific links.

TEE is a computer model for the calculation of consumption and emissions from vehicular traffic at 'microscopic' (street) and 'macroscopic' (city or region) level; TEE model calculates emissions on links where information on driving pattern is available. On links where only the average speed and traffic flow are known, emissions are calculated by TEE using only COPERT methodology; Modal Emissions Estimation Model calculates emission on links controlled by the UTOPIA sub system. On these links detailed data on duty cycle are available and the emission model allows calculating emission values according to driving behaviour defined as the time spent in cruise, acceleration, slow down, and idle.

TEE development is always on going, at present other then CO, C6H6, NO2 it is also possible to evaluate PM10 emissions. Moreover, Heaven project's results stressed the importance of having a more precise and "dynamic" simulation of traffic flows; because higher is the traffic congestion (number of stop and go) and higher is the emission produced by traffic flows. For this reason it has been decided TEE's Kinematics Correction Factor (kcf) will be activated; activating this option it is possible to simulate users driving profiles.

Besides, it is known that COPERT III model does not consider emission factors for gasoline cars, motorcycles and non-exhaust emissions; it implies that for COPERT only diesel vehicles are responsible for PM emission. Therefore, a strong under-estimation and wrong characterisation of PM sources is given applying COPERT III. To overcome this limitation and according to the results of Italian National Research Centres studies (APAT, ENEA), TEE release 2005 incorporates these sources providing a more reliable estimation of PM emissions.

C) Dispersion module

This module has been developed to perform CO, PM10, Benzene and NO2 concentrations evaluation being those pollutants the one detected by the existing Municipality's environmental measurement stations network.

A preliminary study was performed in order to identify the models that allow the calculation of pollutant concentrations over a wide area with a good spatial resolution and hourly time frequency. All the available models in the market are built as closed boxes able to perform a specific task and the normal user can create the complete process from transport to dispersion map with difficult and not repeatable effort.

The definition of a structure for the general database and the timing of the process as well as a common user interface, whose design could be changed during the project according to the user needs we will face, and the I/O requirements of each stage of the process should allow a quick adaptability to different environments and to different models to be adopted according to the specific needs.

ADMS- Urban has been chosen between other investigated models since it allows to take into account up to 1000 emission links in a single run, and requires relatively simple meteorological inputs.

ADMS-Urban, a version of the Atmospheric Dispersion Modelling System (ADMS), is a pollution model developed by CERC (Cambridge Environmental Research Consultants) with the assistance of the United Kingdom meteorological office.

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It is linked to external GIS and visualisation tools and represents a comprehensive tool for tackling air pollution problems in cities and towns. It can be used to examine emissions from 4,100 sources simultaneously, including road traffic, industrial and "background grid" emissions and requires relatively simple meteorological inputs.

This programme, as all existing dispersion modules at urban scale, has been generally used for planning reason while it has been used on-line in the HEAVEN DSS. Results obtained are reliable and have been validate successfully, even if further analysis will be carried out.

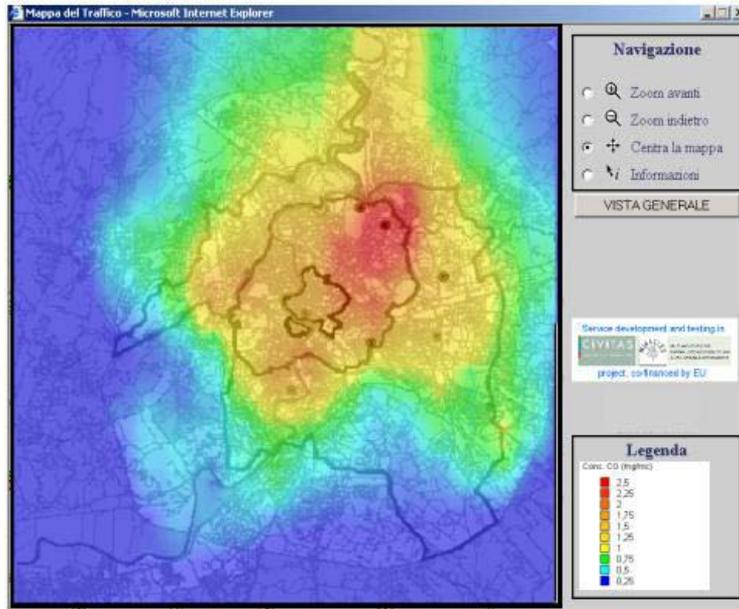


Figure 5: CO mapping with ADMS dispersion module

D) Scenario module

The main focus of the scenario analysis is the off-line evaluation of different traffic demand management strategies (TDMS).

The simulation of traffic impacts of TDMS is carried out using the traffic models available where traffic profiles can be changed according to the investigated measures (change of the vehicular fleet, limitation to the traffic in a specific road or in a road network, etc.). The generated traffic output can be evaluated in terms of emissions and pollution effects, evaluating the effects of the specific TDMS under consideration, also in terms of meteorological and background pollution forecasts, if available. In the following picture, the already developed TDMS test in the old client/server architecture is showed.

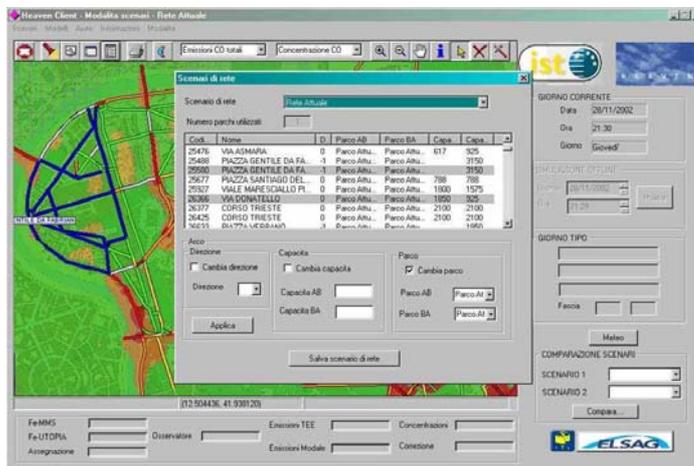


Fig 6: Client/server TDMS interface

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E) Operator interface

Within the MIRACLES project, the operator interface (front end) has been completely redesigned since it was initially developed as a client-server system while it is now a web-oriented front end.

This front end has been developed on an open source basis ensuring a significant reduction of the system costs both in terms of SW licenses and maintenance. In fact, either Oracles and GIS Maptitude needed specific technical competencies for their maintenance. In details, actually MySQL, PHP scripting language and cartographic engine MapServer has been integrated in the system architecture.

Maps elaborated by the system were continuously displayed in a specific area of ATAC web site during MIRACLES Project.

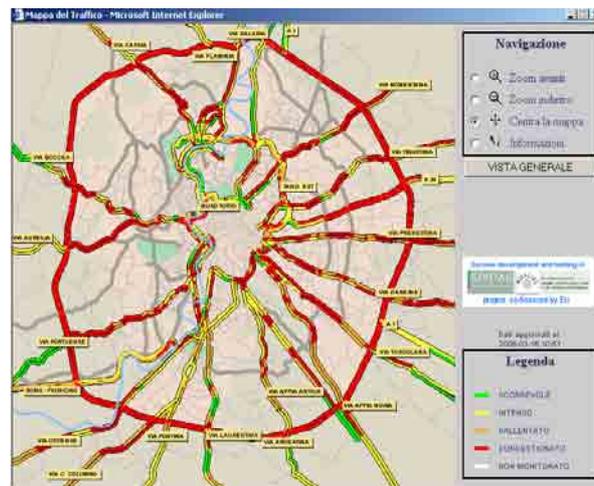


Fig 7: Traffic flows displayed – design prototype

2) ENEA Trial

For what regard ENEA Trial, the first part of the project was devoted to the design of the measuring system “floating van” described here below. After the implementation of the system, as described below, it has also been necessary to calibrate the particulate matter on line measuring equipment.

For the validation and demonstration of the system specific trial tests have also been designed and planned, in close co-operation between ATAC and ENEA; they will be implemented during the years 2004 and 2005 in three different sites, inside the Miracles Laboratory Area: Via Nomentana, Via dei Fori Imperiali and Corso Vittorio Emanuele II.

M6: Actual implementation:

1) Traffic – Environmental model chain

The HEAVEN prototype system has been tested and validated on a laboratory area 16 km² located in the North-East part of the city. It was chosen because it could be considered as a representative part of the entire urban network. In fact, it contains a wide green area (Villa Ada, Villa Torlonia), several radial corridors (Via Nomentana, Via Salaria, Lungotevere) and the inner zone, which is made up of high density neighbourhoods.

Within the MIRACLES project the demonstration area will be extended to the so called “rail ring”, that is the whole Laboratory Area of the Project itself, being its inner area characterised by restrictive mobility policies for private vehicles. This area is almost three times bigger than the previous one, it is in fact 43 km². ATACrting January 2003, within this area was enforced a restriction policy to not catalysed vehicles during working days in order to reduce both pollution and congestion in the city centre.

The extension of the demonstration area, even if it does not represent a problem in terms of computational resource needs, should be treated carefully. Currently, the working period of the system coincide with the traffic data acquisition period and it can not be ensured with the extended demonstration area. This is a key element of the system process because it could lead to the system inefficiency.

During the Project it has been decided to extend the laboratory area to the whole city territory to improve the reliability of the whole traffic-environmental chain. More precisely, pollutant concentration in the Laboratory area are strictly related to the whole city’s pollution emissions; not considering them has initially generated an under-estimation of concentration creating problem in system chain validation.

Actually, the whole chain model has been developed, implemented and evaluated. Thanks to further analysis

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performed on the EU algorithm (developed, implemented and validated by ATAC) it has been possible to determine that, even if the model does not provide reliable information in terms of travel time, it does provide very reliable traffic flow data.

As result of this analysis it has been possible for ATAC to define a general “traffic indicator” by means of which it is now possible to assess the impact on total traffic flow of specific events (e.g. road work on main city corridor) and to assess city’s congestion level and to classify days week according to traffic indicator values. It is defined by the sum of all traffic flows circulating on the network in a specific time period.

Indicatore Traffico 9 settembre 2005

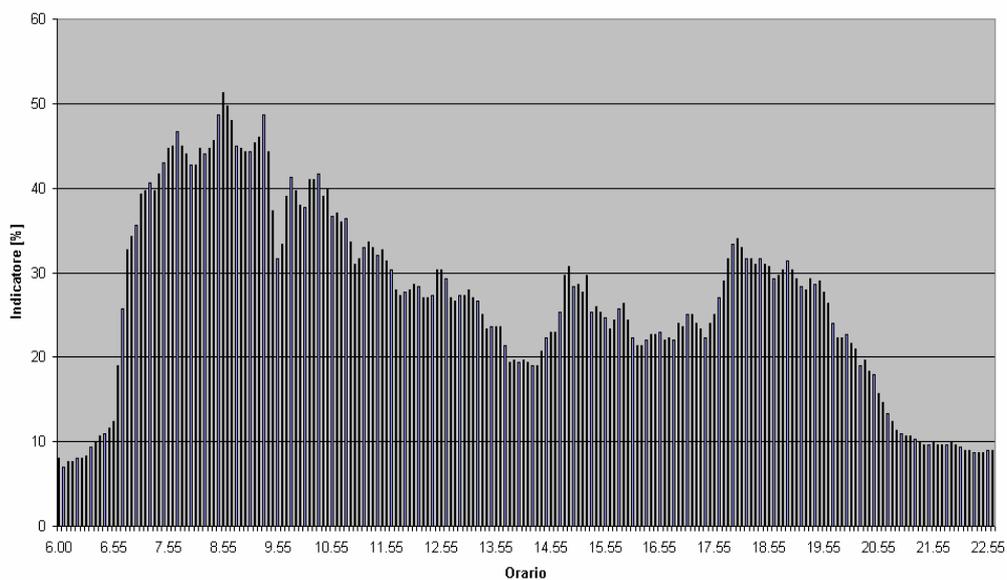


Fig 8: Traffic Indicator from 6.00 to 22.55 – 9/9/2005

Moreover, by means of system’s scenario module it is possible to perform both analysis of previous days and simulation scenarios.

The implementation activities of the system, also carried out in the framework of a co-financed project with the Italian Ministry of Environment, are showing the necessity of integrating the development of the model chain with a meteorological and a background pollution model and to cover a larger scale, at least regional, as showed in the next figure, if a reasonable estimate of the secondary pollutants (NO₂, PM₁₀, PM_{2.5}) has to be carried out. Both models are not a competence of the Municipality. As a consequence, an interrelation model is currently under examination, in order to cover the whole city in a near future

Regional domain 240x200 km, grid 4

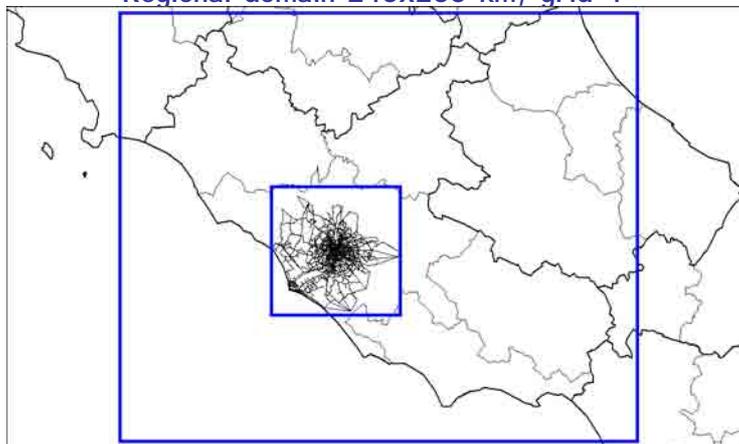


Figure 9: The regional scale for the structural implementation of the traffic-environmental chain

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The architectural solution under implementation in the SICOTRAVIA structural system goes towards a distributed system, where each Body is maintaining its competencies, making its processing, receiving the necessary inputs and providing outputs to other Bodies.

From the information technology side, the use of the Open Source software and IP network is now the solution mostly adopted in each distributed environment. This produces a common web-interface with different levels of access, from citizens to stakeholders is to be integrated in the design solution. The Internet accessibility permits:

- ❖ to have a better control on software
- ❖ to simplify the final users access

Architecture is based on existing open source software in order to reduce costs and to allow a real integration inside the different module of the chain and with the ATAC Traffic Control Centre. Open source software presents anyway “problems” due to the most used cartographic engine MapServer has a scarce integration with adopted MySQL DB (largely used in this kind of context). As a consequence, the GIS web-interface under development in Rome is based on the following characteristics:

- ❖ totally integrated with traffic assignment model and TEE emission model;
- ❖ the cartographic engine will allow advanced analysis, due to choice of the new GRASS platform and it can manage nodes, arcs, zones, multiple layers to view assignment model outputs (vehicles classes, speed classes....), streets names along all the route. As well as it allows queries on each visualised entity and to export maps and queries output to a .pdf format.

The result, showed in the preliminary version in the following picture, features in a common web-interface with different levels of access, from citizens to all stakeholders (national, regional and municipal) integrated in the same design solution.

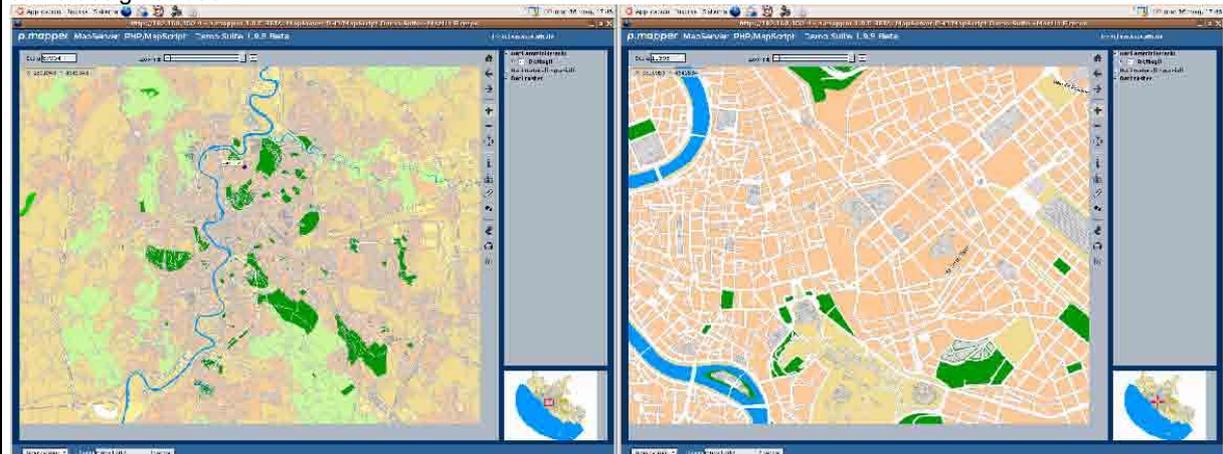


Figure 10: The web-based interface (prel. Version) of the integrated traffic-environment chain in Rome

2) ENEA Trial

The main implementing activities were:

- review, selection and purchasing of the necessary devices;
- preparation and installation of such devices on the mobile laboratory (floating van);

Two different systems were installed on-board of a mobile laboratory (which is a light duty vehicle defined as “floating van”). The instrumentation installed on the “floating van” consist of :

a) a system for the measurement and storage of the kinetic data needed as input by the emission models to give an accurate estimation of the pollutant emissions;

b) a system for the measurement of the particulate matter and of his distribution into the related three classes (PM10, PM2.5 and PM1), in order to elaborate time and space maps of this harmful pollutant along the main bus line routes in the study area.

The equipment for the kinetic data collection (time, space and speed) is able to draw the speed profiles which are one the main input needed by traffic models to precisely calculate pollutant emissions and fuel consumption. The “floating van” running on the route selected as measurement field is able to give useful data about the traffic data and the speed variance during the trip. Moreover the distance travelled can be used to give a geographic reference of the vehicle inside the test area.

The speed measurement system collects and store data about the distance and speed of the vehicle with a sampling frequency of 1 Hz. Space sensor is an incremental encoder with a resolution of 1.5 cm/imp to result in a low error in space measurements over long trip distance. Speed is calculated from the space measured over a

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sampling time of 1 second.

Main characteristics of the “kinematics data logger” are :

- MCS-51 family controller (83C51FB)
- 32 Kbyte di RAM ATACTica CMOS
- 16 Kbyte di ROM
- A/D converter with 8 input MPX
- internal Real Time Clock
- Up to 14 I/O digital lines
- RS-232 communication port
- Internal voltage regulator
- Expansion port (address and data)
- LCD display two lines 24 characters



Fig 10: Kinematics data logger

To detect the dust particles a portable dust monitor was installed on the same “floating van”. The instrument delivers single particle counts and size classifications in real time. The air sample is drawn via a volume controlled pump through a flat beam of light produced by a laser diode. Each scattered signal generated by the particle crossing this beam is detected with a high speed photodiode. The electric pulse generated is analysed by an integrated pulse height analyser and classified in 15 different size ranges and then counted. In addition a PTFE filter collects all the measured dust which is then analyzed by a gravimetric method for verification of the reported mass.

Air sample is drawn into the unit via an internal volume controlled pump at a rate of 1,2 litres/minute. A pipe connect the inlet of the dust analyzer with the probe mounted on the vehicle. The probe is protected with a metal shield to avoid interference from the air turbulence when the vehicle is running.

M7: Deviations from the plan:

1) Traffic – Environmental model chain

No deviation occurred from the original implementation plan. The interest of the Ministry of Environment, partially co-financing the project, of having a common architecture and interface with all the Italian Cities could enlarge the timing for the design finalisation but opens interesting possibilities of standardisation

2) ENEA Trial

The original specifications, as well as the implementation plan of the above mentioned ENEA activities have been slightly modified, in agreement with ATAC. Thus in order to maximize the synergies among the different WP's, and in particular to integrate the implementation plan of the different measures (introduction of new lines, use of zero or low emission vehicles and improved network management) and of the improved environmental control system with the evaluation activities. Changes have been made also for taking into account the most recent results of the research in the field of the air pollutants from traffic, that are now considered more harmful and dangerous for the human health.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For measure 11.2b deviations occurred to the following indicators:

Evaluation category: *Environment*

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<ul style="list-style-type: none"> - Frequency of calculation of CO emissions: added - Frequency of calculation of C₆H₆ emissions: added - Frequency of calculation of PM emissions: added - Frequency of calculation of CO concentrations: added - Frequency of calculation of C₆H₆ concentrations: added - Adequacy of calculation of CO and C₆H₆ concentrations: added Evaluation category: <i>Transport</i> <ul style="list-style-type: none"> - Frequency of service: renamed with “calculation of traffic flow and speed” 	
The Evaluation – how was it done and what are the results?	
M8: Method of measurement:	
<p>The Traffic Control Centre located at ATAC, gathers traffic information (flows and average speed) every five minutes directly on one third of the demonstrative area primary road network.</p> <p>The air quality network of the Municipality of Rome provides information on an hourly basis of pollutant concentration in the area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives.</p> <p>Through these two systems, it is possible to achieve a good description of the traffic on the primary road network and to have local information on air quality to evaluate the system performances and associated errors.</p> <p>More specifically, information on environment came from air quality assessments concerning the emissions of CO, particulate and benzene. In this case, for the ex ante evaluation, data from the HEAVEN project were used; in particular the TEE model, supplied by ENEA, calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry. Moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration have been carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution was available to perform evaluation on the system capability in reconstructing the pollutant dispersion fields in the city.</p> <p><u>Transport Indicators</u></p> <p>Besides, the set-up of the so-called “Mobility Observatory” in ATAC by the Mobility Department is permitting a continuous updating of all the mobility data. The Mobility Observatory is also taking continuous advantage of the traffic monitoring data coming from the Traffic Control Center located in ATAC, where complex systems are putting always in better way the traffic situation of the city.</p> <p>Specifically for what regard ENEA trial, progress and implementation reports on:</p> <ul style="list-style-type: none"> ❖ equipment design and device specifications; ❖ equipment preparation and installation; ❖ calibration campaign; ❖ measurement campaigns for equipment testing and demonstration 	
M9: Achievement of quantifiable targets:	
<p>This measure has to contribute, through the support given by new traffic indicators and air quality simulations to an immediate updated analysis of the environmental situation of the city, to achieve the MIRACLES overall results in the city of Rome itself. Expected results are:</p> <ul style="list-style-type: none"> ❖ Reconstruction and description of real-time traffic flows (5') and speed on the primary network for the whole Miracles Laboratory Area; ❖ Near real time description of traffic, pollutant emission and pollutant concentrations with grid maps on the Laboratory Area. An hourly description of emissions and concentrations of CO, Benzene and PM will be provided on the area with a detailed spatial resolution ❖ Simulations on the expected benefits coming from MIRACLES TDMS both in transportation and environmental analysis. <p>For what regard ENEA trial, the selection and purchasing of the necessary devices, the preparation and installation of such devices on the mobile laboratory (floating van), the calibration of the PM on-line monitoring instrument, and the testing and demonstration of the system.</p>	
M10: Achievement of evaluation-related milestones:	
<p>M1: Extension of the information platform on traffic flows and speed on primary network with detailed real-time pictures of traffic flows and traffic events (Month 27): completed. Results available on ATAC website, updated every 5 minutes.</p> <p>M2: Environmental system extended to the whole Laboratory area able to analyse transportation and environmental benefits of MIRACLES (Month 34): completed. On going the passage from the prototype to a</p>	

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permanent system, to be used on a regular basis by the Municipality and to be further extended.
M3: start Experimentation with “floating van”: started in October 2005. Detailed results soon available.

M11: Report on the measure results:

In the following, an analysis on the achieved results for each one of the detailed quantifiable results in M9 is reported. No complete traffic-environmental TDMS analysis is reported because the chain was applied through the different measures applied in Miracles and only other measures are here reported to show the system possibilities.

1) Reconstruction and description of real-time traffic flows (5') and speed on the primary network for the whole Miracles Laboratory Area

With the use of the Traffic – Environmental chain and by means of system's scenario module it is possible to perform both analysis of previous days and simulation scenarios. Hereafter three examples on benefits related to the usage of the traffic indicator are briefly reported; these are:

- a. “Thursday with alternative plates rule ”
- b. “No cars Sundays”
- c. Analysis of August 11th 2004 where, even if the period of the year can be considered a weak traffic period

❖ **Thursday with alternative plate rule:** during year 2005, Rome Municipality decided to set-up a limitation to the circulation in the laboratory area to face the threshold overcome in PM 10 limits. On 10 Thursdays, alternatively cars with even and odd final number of plate were authorised to circulate in time band from 9.00 to 12.00 and from 15.00 to 19.00. The results (see the following figure), comparing the mean Thursday with two days of measure application are showing the limited impact of the measure, acting especially in the afternoon period, where anyway a limited decrease of traffic flow (10-15%) was recorded.

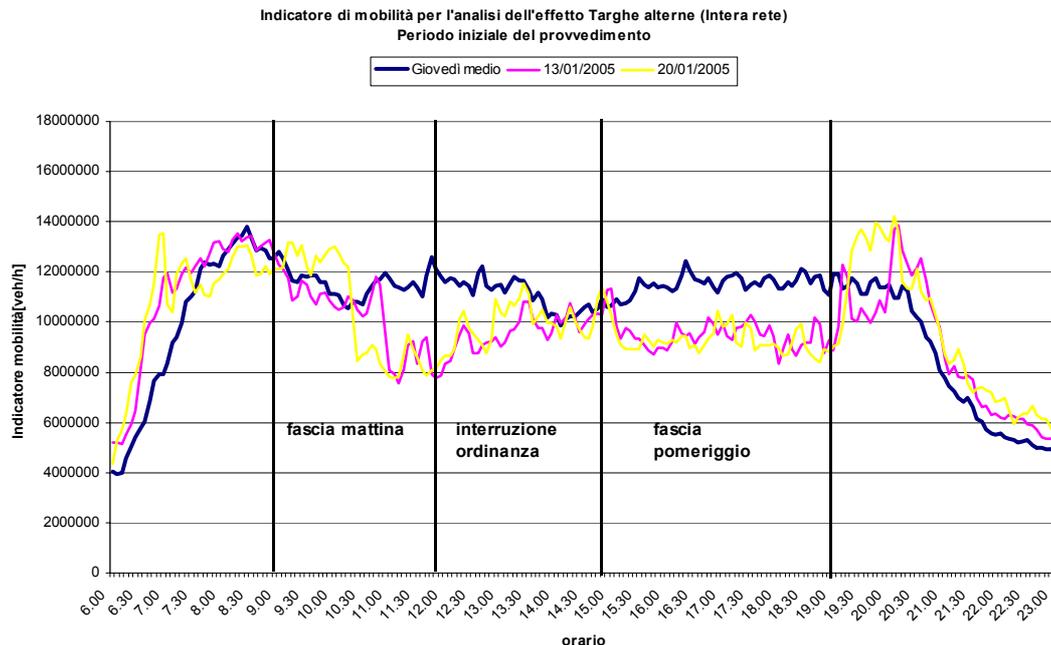


Fig. 11: Alternate plate traffic analysis

❖ **No cars Sundays :** during year 2005, Rome Municipality decided to set-up a limitation to the circulation in the laboratory area also on some Sundays, always to face the threshold overcome in PM 10 limits. On 3 Sundays, cars and 2-wheels were stopped in LA from 10.00 to 18.00. The results (see the following figure), comparing the mean Sunday with two days of measure application are showing the high impact of the measure, acting with a huge decrease of the traffic flow (about 40%) was recorded.

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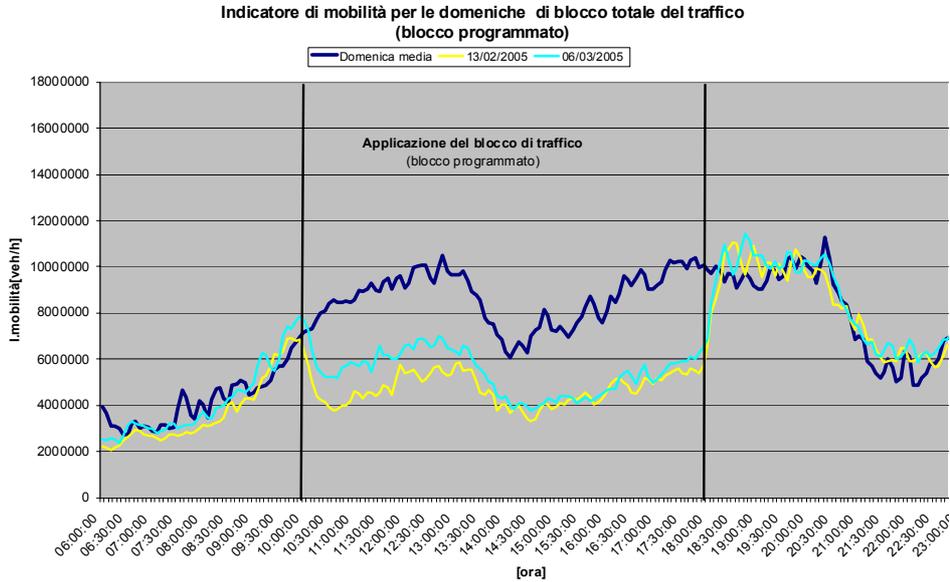


Fig. 12: No cars Sundays traffic analysis

- ❖ **Analysis of August 11th 2004.** Typically, August is weak traffic period in Rome, due to school closure and holiday period. Anyway, in that date an overcome of the PM10 threshold was registered. The traffic indicator analysis showed that the decrease of the traffic flow in that day, compared to another day in school closure period is low. Besides, the unexpected closure of a main road axe, due to specific problems, created congestion in evening hours that, joined with unfavourable meteorological conditions, made possible the PM10 alert.

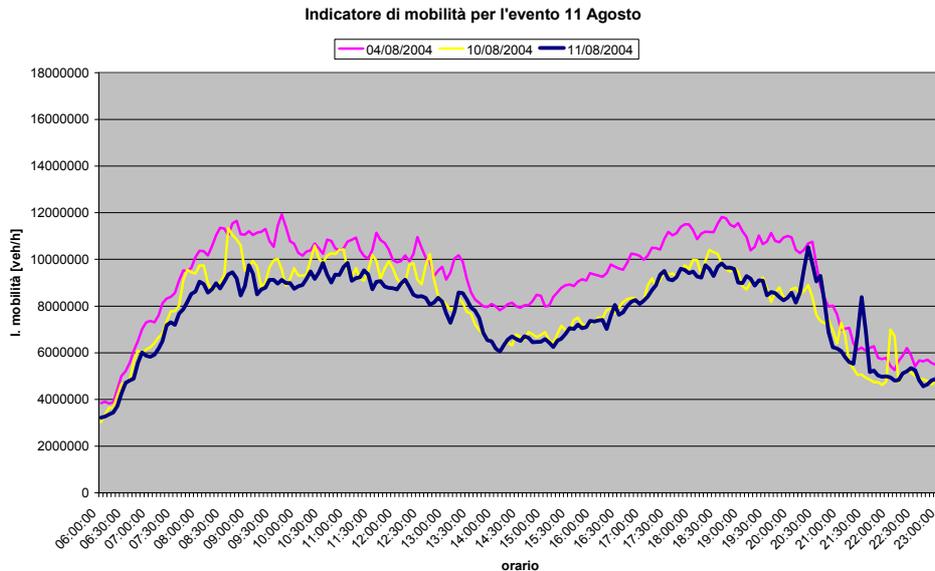


Fig. 13: August 11th, 2004 traffic analysis

2) Near real time description of traffic, pollutant emission and pollutant concentrations with grid maps on the Laboratory Area

Analysis were developed on the dispersion model results. Due to the lack of a background pollution model, evaluation was carried out on CO (Carbon monoxide) results on some selected days, compared with values

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measured by the air quality monitoring stations.

The results reported in the following graphs, showed a very good agreement with the so-called “residential stations”, i.e. not directly subject to emission sources, while the agreement decrease when dealing with “traffic stations”, directly receiving the impact of local emission sources.

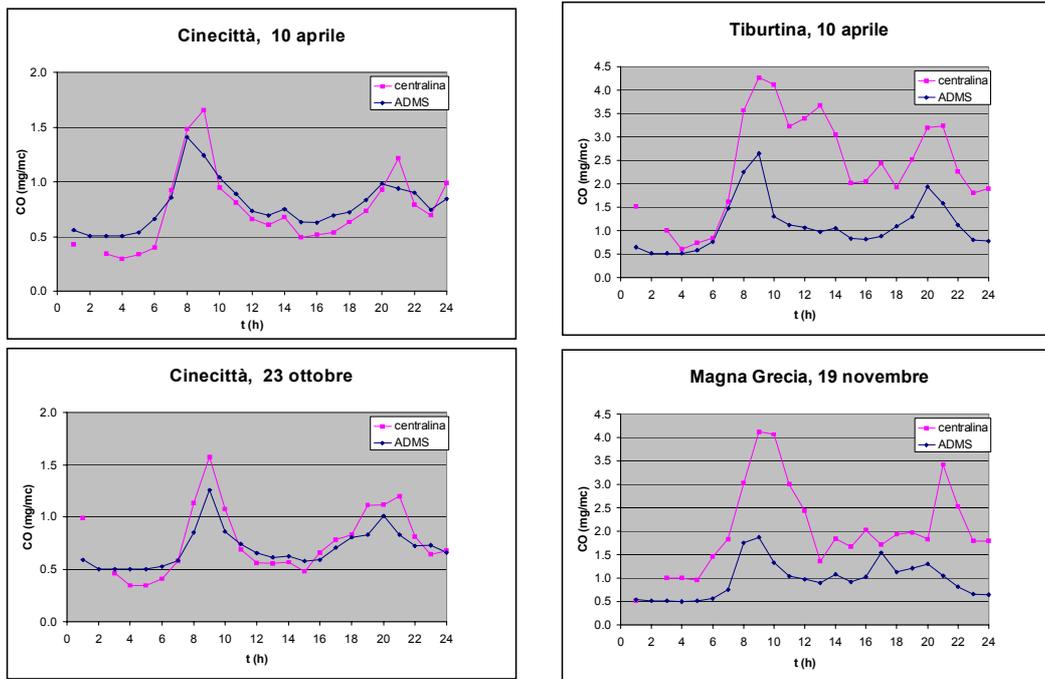


Fig. 14: CO model outputs, compared with measured values.

The need of a nested approach also in urban environment was thus evident. The integration of canyon subroutine &/or the nesting with downscaled ADMS run in hot spot sites, permitted to reach a good agreement also in traffic sites, as shown in the following picture.

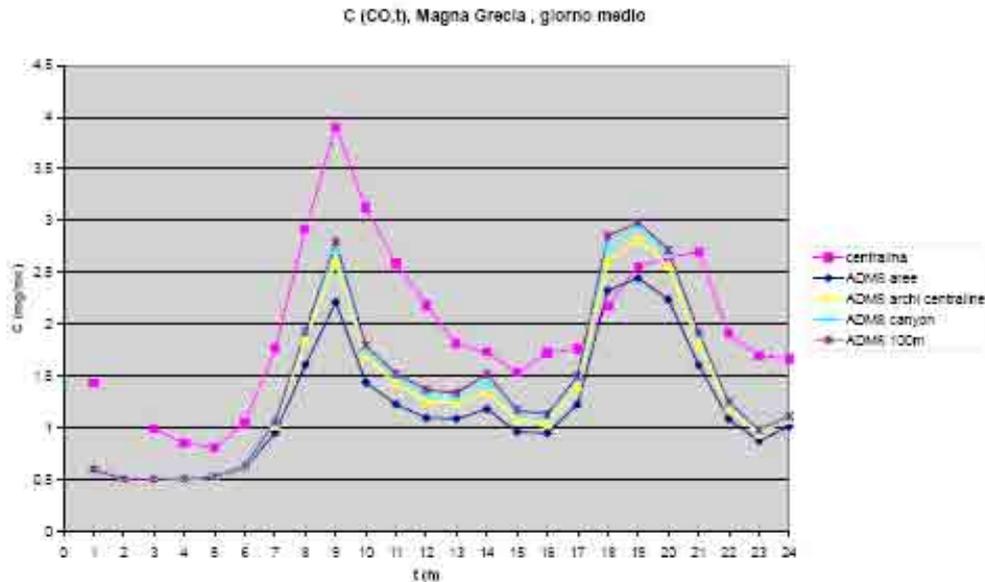


Fig. 15: Nested CO model output in traffic sites, compared with measured values.

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3) ENEA Trial

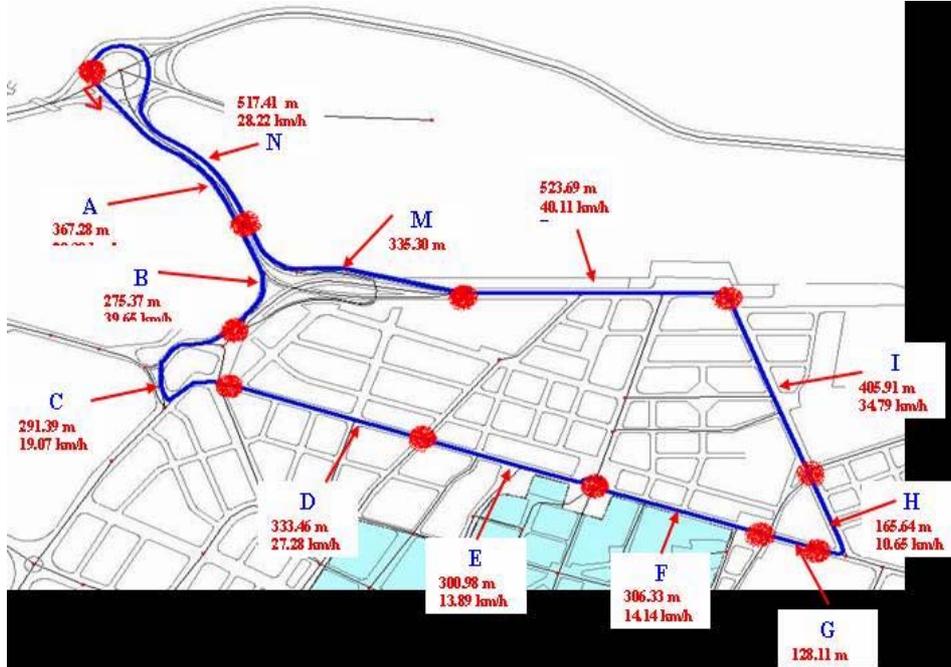


Fig. 16: kinetic data measurements.

The above figure shows, as an example, the kinetic data measurements carried out to test the floating van system: the blue line indicate the floating van route and the red points are control points dividing the route in many sections along which the different kinetic parameters are calculated.

The figure below shows the resulting speed-space curve (the red bars are corresponding the control points).

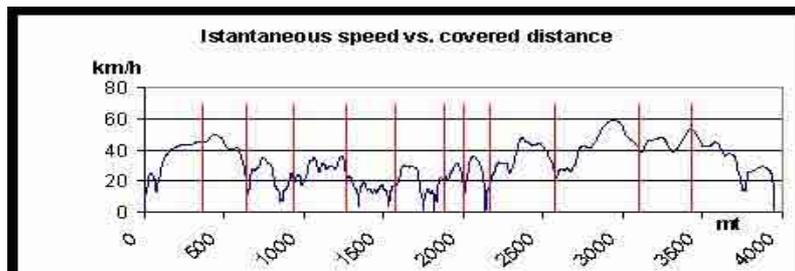


Fig. 17: Resulting speed-space curve.

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All results for ex-ante and ex-post situations are reported in table 1.

Table 1: ex-ante and ex-post measures for Task 11.2 in MIRACLES project

<i>Measure 11.2: Improved network management-Information</i>									
1	2	3	4	5	6a	6p	7	8	9
Evaluation category	Impact	MIRACLES number	METEOR number	Indicator (Units)	Ex-ante value (2001)	Ex-post value (2004)	Methods	Data sources	Notes
Economy	System operating costs	R11.2/Econ.1.a		Cost for operating (€/inh)	-	0,05		STA	
Environment	Emissions	R11.2/Env.1.a	9	Frequency of calculation of CO emissions /year in the MIRACLES Lab Area	1	8760	By traffic model output calculation of emissions by dedicated TEE model	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Once per year during Air Quality Report analysis 12/2005: On-line model calculation
		R11.2/Env.2.a	10	Frequency of calculation of particulate matter emissions /year in the MIRACLES Lab Area	1	8760	By traffic model output calculation of emissions by dedicated TEE model	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Once per year during Air Quality Report analysis 12/2005: On-line model calculation
		R11.2/Env.3.a		Frequency of calculation of C6H6 emissions /year in the MIRACLES Lab Area	1	8760	By traffic model output calculation of emissions by dedicated TEE model	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Once per year during Air Quality Report analysis 12/2005: On-line model calculation

<i>Measure 11.2: Improved network management-Information</i>									
1	2	3	4	5	6a	6p	7	8	9
Evaluation category	Impact	MIRACLES number	METEOR number	Indicator (Units)	Ex-ante value (2001)	Ex-post value (2004)	Methods	Data sources	Notes
Environment	Calculation of Concentrations	R11.2/Env.1.b	5	Frequency of calculation of CO concentrations /year in the MIRACLES Lab Area	1	365, each with 24 values	By traffic model output calculation of emissions by TEE model and dispersion by ADMS model	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Once per year during Air Quality Report analysis 12/2005: On-line model calculation
		R11.2/Env.2.b	6	Frequency of calculation of C6H6 concentrations /year in the MIRACLES Lab Area	1	365, each with 24 values	By traffic model output calculation of emissions by TEE model and dispersion by ADMS model	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Once per year during Air Quality Report analysis 12/2005: On-line model calculation
		R11.2/Env.2.c		Adequacy of calculation of CO & C6H6 concentrations in the MIRACLES Lab Area	NA	80% (R) 40% (T)	Comparison between calculated and measured value by monitoring network	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	Substantial adequacy of the model chain for primary pollutant in Residential (R) areas. Need of nested hot spot subroutine in Traffic (T) zones
Transport	Calculation of traffic flow and speed	R11.2/Tran.1.a		Calculation of traffic flows and speed in the primary road network every 5 minutes (in km)	160	700	By traffic model output calibrated with traffic monitored network	STA & Rome municipality- DipX Integrated with SICOTRAVIA Project	2001: Calculated only in monitored part of the network 12/2005: On-line model calculation for the whole primary network

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b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
Reconstruction and description of real-time traffic flows (5') and speed on the primary network for the whole Miracles Laboratory Area	The Traffic – Environmental chain was built. A new Traffic Indicator was created and tested.		☺☺☺
Near real time description of traffic, pollutant emission and pollutant concentrations with grid maps on the Laboratory Area. An hourly description of emissions and concentrations of CO, Benzene and PM to be provided on the area with a detailed spatial resolution.	Analysis were developed on the dispersion model results. Due to the lack of a background pollution model, evaluation was carried out on CO (Carbon monoxide) results on some selected days, compared with values measured by the air quality monitoring stations. The need of a nested approach also in urban environment was evident.		☺☺
Simulations on the expected benefits coming from MIRACLES TDMS both in transportation and environmental analysis	By means of system's scenario module it is now possible to perform both analysis of previous days and simulation scenarios. Testing activities on specific policies were carried out during MIRACLES		☺☺☺
ENEA trial: selection and purchasing of the necessary devices, preparation and installation of such devices on the mobile laboratory, calibration of the PM on-line monitoring instrument, and testing and demonstration of the system	Two different systems were installed on-board of a mobile laboratory (which is a light duty vehicle defined as "floating van"). The calibration, as well as the testing of the whole system was carried out during MIRACLES.		☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☹ difficult to assess ☹ not achieved</p>			

Status of the Measure beyond MIRACLES

1) Traffic-environment system chain

As already mentioned, the measure is going to be completed with some modifications/improvements and it will continue beyond MIRACLES in a structural way

2) ENEA floating van

Discussion and meeting were already carried out in order to define how to continue the use of such method in order to support the validation of the traffic-environment system chain and to support mobility measures.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

Urban areas are home to almost 80% of the European Union's population and most of the industry and traffic is concentrated here. Emissions of air pollutants and noise caused by road traffic are of particular concern to many European citizens. At local, regional, national and EU level efforts are being undertaken to reduce these adverse impacts on citizens and the environment.

The European Commission has already introduced a series of directives to improve air quality and to reduce noise levels. The Council Directive 1996/62/EC on Air Quality Assessment and Management (Framework Directive) and the associated Daughter Directives address the regular assessment of air quality through monitoring and modelling in urban agglomerations (< 250.000 inhabitants), call for Action Plans to improve air quality and require public information. Currently, the Clean Air for Europe programme (CAFE) within the 6th Environmental Action Plan is developing the thematic strategy for the further reduction of air pollution and its effects. Next to air quality, the problem of noise in densely populated areas is also of importance to most citizens. It is estimated that at least 20 % of EU population suffers from noise and its adverse effects on the quality of life. The Council Directive 2002/49/EC relating to the assessment and management of environmental noise obliges

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larger cities to produce noise maps, which indicate the number of people exposed to certain values of new harmonised noise indicators. On the basis of such noise maps, cities will have to develop Action Plans aiming to achieve noise limit values, which will be set on Member States' level.

Today, European cities face the challenge to ensure quality of life and economic growth while at the same time controlling traffic and its related pollution. Strategies are needed to face traffic demand and the environmental problems, but rational procedures and technical tools suitable to elaborate effective solutions are too often missing.

The concerns for poor air quality in these years in Rome, with threshold limit values often not respected, are giving strength to the policies aiming to a re-balance of the modal split towards collective transport and restrictive measures to the private vehicles like the on-street parking pricing are more accepted than ever in Rome.

Besides, the situation in Rome regarding the compliance with such directives is putting the city in continuous emergency conditions, where mobility emergency measures (like alternate circulation based on plate number or partial/full circulation blocks) are becoming familiar to all the citizens.

The limits of the legislation and consequently the barriers for the implementation have to be searched in the division of competencies among different territorial bodies. Lazio Region is the responsible for the pollutant emissions in the Region also through its technical environment body (ARPA Lazio, while the national authority (APAT) is taking account of the trans-national and national emissions. In this complicate framework, the Mayors and the administration of Lazio cities, Rome firstly, are the responsables for preserving the health of the citizens and the respect of the EU Directives.

The attempt is anyway to translate the scheme of competencies in a working model in order to guarantee the implementation of such measure in a structural way. The definition of a suitable relationship model among the involved and interested Bodies is a primary step, to be transferred in the ITS architectural design..

The architectural solution to be implemented in the structural system goes towards a distributed system, where each Body (APAT, Lazio Region, ARPA Lazio, Rome Municipality) is maintaining its competencies, making its processing, receiving the necessary inputs and providing outputs to other Bodies.

The chain developed with such measure could allow region and cities to assess the impacts of traffic on air quality and noise pollution in near-real time and support decision making have been developed. This innovative tools, merging monitoring- and simulation systems by means of Information Society Technologies, is a Decision Support System able to provide a better description in near real-time of the environmental impacts mainly induced by traffic and to assist the cities in identifying Traffic Demand Management Strategies reducing such impact of traffic on the environment. The application of this DSS in a regional area could provide a concrete sustainable development perspective.

M13: Interrelationships with other measures

7.2 Information,
 11.1 Improved multi modal travellers information
 and, specifically for what regard ENEA trial, the evaluation of the environmental impact of the Clean Public Transport Fleet (New trolley line 90)

M14: Lessons learned

The implementation of mobility measures able to reduce the impact on air and noise emissions of the urban traffic is now part of the before design and matter of the after evaluation of the benefit of the specific measure. On the other hand, based upon the experiences, before in HEAVEN project and afterthat in this MIRACLES measure, the use of chain of models able to evaluate the impacts on the environment created by Traffic Demand Management Strategies in urban context it is useful, but for its correct working and optimal use of the generated results is recommended:

- 1) **To translate the scheme of competencies in a working model.** The definition of a suitable relationship model among the involved and interested Bodies is a primary step, to be transferred in the ITS architectural design. This step should involve consideration about a distributed model to be approved by all the involved Bodies, in order to find a way of operating within the established competencies.
- 2) **To be ready in using technologies easily adaptable to changes.** The choice of technologies is to be carefully taken into consideration as well as the expected development in order to save investments. Full use of web technologies for graphical user interface as well as open source software for engines development and wireless communication are the trend to be considered.
- 3) **To inter-compare models used to compute the contribution of traffic to urban air and noise quality.** In general, member states apply nationally developed models. There is lack of information on the quality of the performances of these models, for example on accuracy, spatial and time scale. Hence, there may be differences between the various member states on the quality of the models to assess compliance with EU-

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- regulations
- 4) **To improve emission factors for air pollution caused by urban traffic.** In general, emission factors are based upon EU-standardised test-cycle. However, urban traffic is characterised by stagnation, “stop-and-go” driving and cold catalysts, which results emission factors that differ substantially from those derived from standardised tests. Besides, the PM factors are generally considered only by diesel car and by exhaust emissions only. The research is demonstrating that gasoline cars, 2-wheels and non-exhaust factors are PM emission sources not negligible. Hence, application of more realistic emission factors is especially relevant in an urban environment.
 - 5) **To inter-compare and further develop public information approaches regarding the impact of noise and air pollution caused by urban traffic.** In order to inform the public, thereby also increasing public awareness, the impact of traffic on air quality and noise nuisance in urban areas can be communicated in various ways to the general public. The information may be available on a web site, or in the media. It may relate to excesses information only, but it may also include recommendations on preferred behaviour by the public. There is a need to compare the various approaches in the different member states in order to improve the effectiveness of the communication.
 - 6) **To integrate information on air pollution, noise and safety.** Presently, the impact on air quality, noise nuisance and safety aspects of hazardous road transport are reported and managed separately. In an urban environment, traffic is a major contributor to all three aspects and hence, controlling air pollution by traffic measures may also favourably affect noise nuisance and external safety. Although there are progress to consider air quality and noise in an integrated way, there is a need to further integrate these issues, especially safety.
 - 7) **To inter-compare the effectiveness of various traffic measures.** Different traffic measures are implemented to reduce air pollution and noise impact caused by traffic. These measures relate e.g. to speed control, to establishing one-way traffic and to reducing the number of specific vehicles on a road, such as buses and trucks. There is a need to further evaluate the cost – and environmentally effectiveness of these various traffic measures and to develop action plans where they are required.
 - 8) **To emphasise environmental and traffic management directed at “hot spots”.** Excesses of standards are generally related to relatively small areas within a city, for example near a heavy-traffic road crossing or stagnant traffic in a street canyon. In the integrated assessment methodologies used for the preparation of European air quality legislation, hot spots like this – and even to some extent the urban scale – are not systematically addressed. These hot spots are not only important from the legislative point of view, but also need attention because they are often subject to large public concern.

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21. Measure 12.1- Clean vehicles - Buses

MEASURE-LEVEL RESULTS	
Measure title: Clean Vehicles - Busses	Project: Miracles
Measure number: 12.1	City: Roma
The Measure – what is it about?	
M1: Measure objectives:	
<ol style="list-style-type: none"> 1) To extend the electric buses fleet; 2) To introduce 30 bi-modal Trolleys; 3) To renew the traditional bus fleet, according to the best emission standards and to lower, up to halving, the average age of the bus fleet; 	
M2: Measure description:	
<p>1) Two parallel processes to purchase two sets of electric buses have been carried out.</p> <p>The first one concerned the enlargement of the present fleet with 10 new (5mt) traditional e-buses. The tendering process, the acquisition and the operation of these new buses has been completed according to the schedule.</p> <p>The second one was an ambitious project: the purchase of 36 bigger (9mt) e-buses with higher battery autonomy to be put into service on a larger area of the city. All the tendering procedures necessary to carry out this task have been performed by ATAC on schedule, but the problem of the procurement of this kind of vehicles was raised, since no technology industry on the market could satisfy the requirements. During 2003 ATAC has been preparing a new call for tender; the administrative specifications of the bid have been revised in order to allow a new tendering in 2004.</p> <p>2) The introduction of 30 “new generation”, bi-modal trolley buses has been performed, after a period of tests in Budapest. Now the vehicles are running on the line n°90 (refer to task 7.3)</p> <p>3) concerning the traditional bus fleet, 2 important targets have been achieved:</p> <ul style="list-style-type: none"> o Compared to the beginning of the project, when most of the bus fleet (2.550 buses) the average age of the fleet is now 5,75 years, compared to 12 years in the year 2000. o Concerning the environmental aspects, 908 EURO III buses have purchased already in 2002, whilst 200 more EURO III CRT buses have entered in operation in 2004. <p>These buses are equipped with the (CRT) system, which The CRT system significantly reduces overall emission levels from buses, allowing them to achieve EURO IV standards.</p>	
The Implementation – how was the measure implemented?	
M3: Innovative aspects:	
<ul style="list-style-type: none"> o The new trolley represent the first application of battery propulsion to a heavy load vehicle o The CRT (Continuous Regenerating Trap) on buses allows buses to have a significant reduction in the overall emission levels, such to perform almost the EURO IV standards already in 2004 in particular it reduces PM 10, the most important traffic pollutant in Rome. o Offer key findings on the battery propelled vehicles: trolleys, electric mini-buses, electric “middle-buses” 	
M4: Situation before CIVITAS:	
<ul style="list-style-type: none"> o Electric buses have been running in Rome since 1989, and since 1996 a quite large fleet of 42 buses (5 mt buses; max capacity: 27 people; equipped with pb-acid 585 Ah batteries; autonomy of 45 km) has been operating on three lines with a total production of 1,200,000 vehicle-km per year, (which means about 1% of the service offered by the surface network). o No preliminary works or implantations for a Trolleybus line had been made before MIRACLES; nevertheless in Rome the trolleybus used to run four lines between the forties and the sixties. o At the beginning of the Project the traditional bus fleet mainly consisted of old and polluting buses (EURO 0), which were not compliant with the European emission standards in force. 	
M5: Design of the measure:	
<p>The measure has been designed according to the following:</p> <ol style="list-style-type: none"> 1) <i>Electric and traditional fleet renewal</i> : <ul style="list-style-type: none"> o <u>Fleet renewal policy</u>: the electrical fleet will be increased with 10 new electric buses; 900 new endothermic Euro 3 compliant vehicles will replace the old endothermic busses running; o <u>Purchasing procedure</u>: publication of the call for tender for the purchase of the buses; o <u>Vehicles lines assignment</u>: planning of the allocation of the new buses to the lines inside the laboratory 	

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area;

2) *Reduction of the environmental impact of the PT fleet:*

- o Empowerment of the electrical fleet in the Trastevere district;
- o Substitution of the endothermic vehicles currently running on 2 or 3 lines with electric buses.

M6: Actual implementation:

1) **Electric buses** have proved to be instrumental for the success of the Zero Pollution Project as they are able to serve an environment characterized by very narrow roads. They are greatly appreciated by the users: besides being non pollutant, the most appreciated qualities are: comfort and silence.

On the contrary, unfavourable characteristics are: their small capacity (27 passengers), limited dynamic performance and, above all, their limited range (about 45 kilometres or 6 hours of operation) which requires a special operation procedure: as the state of charge of the battery approaches the zero level, the vehicle must be brought back to the depot where the battery is replaced by a fully charged one. Operation costs and the fleet size in comparison with the service to be offered are obviously higher than those afforded by conventional buses.

The role of electric vehicles will keep on being a key element for the success of the extensions, but an upgrading of their performance will require advanced technological solutions.

As a matter of fact, present performance could be inadequate owing to the longer length of the routes where the vehicles would depend on an on-board electric source of energy, batteries in particular. Therefore, ATAC is paying special attention to the following improvements

ATAC has launched a **new call for tender** (n°17/04) the new 36 electric "Middle-sized" will be put in operation in 2006 when the supply will have been completed. Anyway during the relevant reporting period technical tests have been performed on a prototype bus along some "difficult" paths in Rome in order to test the main performances of the vehicles, which are the following: 135 km covered with one battery charge, max speed: 55km/h, 15% slope covered.

Anyway the main requirements of the tender were:

- Improvements in the performance of batteries, mainly in their energy storage capacity (for example a limit of 200 Wh/kg would be very attractive), in life cycle and, overall, in price.
- Capacity: about 40 passengers;
- Range: either 180 kilometres or 12 hours continuous operation;
- Admittance for recharging during stops at the terminus.

DATA	14/12/2005	16/12/2005	19/12/2005	20/12/2005	21/12/2005	03/01/2006	05/01/2006	10/01/2006	31/01/2006
ORA	12.25	11.40	12.35	16.32	11.05	16.48	12.41	14.55	14.04
Km	2556	2792	3171	3330	3407	3717	3954	4632	7382
S.O.C. [%]	68,3	77,9	69,7	50	77,7	50,6	71	55,4	66,9
TENSIONE [V.]	554	555	554	553	555	553	555	554	554
TEMP. [°C]	301	297	298	297	298	302	299	302	298

Table 1 – data sheet of the experimentation over the 9 mt electric bus

Concerning the **traditional electric buses** 10 new have already been put in operation

Characteristics:

- o Max length: 5,1m
- o Max width: 2,3 m
- o Passenger capacity: 27+1
- o seats: 8
- o standing room : 19
- o Engine : c.c - 24,5 kW;
- o Batteries: Pb acid - 585 Ah
- o Voltage : 72 V
- o Autonomy : 45 Km

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Figure 1 – Comparison between the old and the new mini buses in service now

2) The **trolleybuses** probably represent the first application of battery propulsion to a heavy load vehicle. The performances required by the tender were:

- Running the vehicle for a route length of 3.2 kilometres, at 2/3 of total capacity, maintaining all the auxiliary groups (lights, windscreen wipers, displays, etc.) in function, the only exception being either the heating or air conditioning of the passenger compartment). The route includes a stop at the central terminus;
- maintaining at least 25% of the energy stored by the batteries when the vehicle reaches the end of the route;
- being able to recharge the batteries entirely along the route running under the overhead line;
- guaranteeing a life cycle not shorter than five years;



Figure 2 - The new Trolleybus operating on the line n°90

Actually the basic technical features of the **trolleys** are:

Vehicles:

- Length: 18 m
- Weight: 20,100 kg
- Passengers (seating): 139 (46)
- Max power: 260 kW
- Nominal consumption: 3.3 kWh/km

Batteries:

- Nominal voltage: 480 V
- Nominal capacity: 80 Ah
- Weight: 840 kg
- Energy: 38.4 kWh
- Nominal consumption: 3.3 kWh/km

The battery consists of 80 elements of Nickel-Metallhybride, divided into two packs of 40 elements each; they are air cooled and constantly monitored by a battery manager. The battery can also be recharged or – better – equalized in the depot.

The prototype provided by Ganz Transelektro was tested in Budapest in December 2003 by simulating the real route conditions, in order to achieve the same energy consumption over the 3.2 km section run by battery

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propulsion.

The test proved successful: the battery matches the requirements maintaining a SOC between 80 % (standard top SOC level suggested by Gold Peak, the battery supplier, in order to limit thermal stress) and 40% once it reaches the end of the route. It was also proved that the battery can be **recharged in about 30 minutes** when the vehicle is running under the overhead line, this ensures keeping the energy balanced during operation.

These vehicles are implemented on the line "90 Express" and are appreciated for their peculiarities of being silent, environment-friendly, comfortable and are equipped for the mobility impaired.

N° es.	Km al 01/07/05	Km al 30/09/05	Differenza Km	N° es.	Km al 01/10/05	Km al 31/12/05	Differenza Km
8501	6.701	17.856	11.155	8501	17.856	34.666	16.810
8502	3.534	16.809	13.275	8502	16.809	28.013	11.204
8503	7.532	17.523	9.991	8503	17.523	32.535	15.012
8504	6.376	6.471	95	8504	6.471	11.054	4.583
8505	12.376	23.588	11.212	8505	23.588	38.862	15.274
8506	9.942	20.604	10.662	8506	20.604	31.398	10.794
8507	9.924	19.756	9.832	8507	19.756	33.606	13.850
8508	10.814	10.814	0	8508	10.814	15.597	4.783
8509	13.928	19.381	5.453	8509	19.381	27.993	8.612
8510	15.609	27.310	11.701	8510	27.310	41.926	14.616
8511	10.129	17.912	7.783	8511	17.912	17.912	0
8512	14.367	28.492	14.125	8512	28.492	43.032	14.540
8513	8.704	9.848	1.144	8513	9.848	20.246	10.398
8514	4.727	12.081	7.354	8514	12.081	13.660	1.579
8515	18.745	28.751	10.006	8515	28.751	43.471	14.720
8516	19.163	28.045	8.882	8516	28.045	42.860	14.815
8517	15.709	26.895	11.186	8517	26.895	41.196	14.301
8518	11.473	17.883	6.410	8518	17.883	29.952	12.069
8519	7.754	18.558	10.804	8519	18.558	32.653	14.095
8520	5.326	16.408	11.082	8520	16.408	29.847	13.439
8521	9.403	12.337	2.934	8521	12.337	12.338	1
8522	6.526	13.039	6.513	8522	13.039	24.490	11.451
8523	10.556	16.155	5.599	8523	16.155	16.155	0
8524	11.465	18.519	7.054	8524	18.519	26.557	8.038
8525	11.388	18.588	7.200	8525	18.588	30.693	12.105
8526	15.481	23.532	8.051	8526	23.532	33.646	10.114
8527	4.604	9.676	5.072	8527	9.676	18.587	8.911
8528	5.493	9.908	4.415	8528	9.908	17.596	7.688
8529	3.198	6.529	3.331	8529	6.529	15.987	9.458
8530	251	4.776	4.525	8530	4.776	7.720	2.944
TOTALE	291.198	518.044	226.846	TOTALE	518.044	814.248	296.204

Table 2 – data sheet of the trolley service monitored

3) At the end of 2003, the contract for purchase of 300 new **Euro III CRT** buses has been awarded: Evonbus Mercedes Citaro is the supplier for a fleet of 300 new busses CRT equipped. (Citaro won among a choice set formed by BredaMenarinibus, Isisbus, Neoman, Scania and Solaris).

The busses are 12m length, powered by a diesel engine, Euro III compliant, but equipped with CRT – Continuous Regenerating Trap - system that will allow to reach the performance of a Euro IV vehicle, improving the current environmental needs.

All the busses are equipped with air conditioning and low floor; the 200 dedicated to urban service are equipped with two seats reserved to handicapped people, 18 seats and 3 doors to access the vehicle, monitors with the MOBY system (task 7.2.2).

M7: Deviations from the plan:

No deviation occurred from the original implementation plan, but the largely detailed delay due to the procurement of the 36 new generation middle sized electric buses.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first

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amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For measure 12.1 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Income for PT sold tickets.*: removed because not reliable data could be determined concerning the amount of sold tickets for clean buses only; indeed just the overall amounts of tickets and passes of the whole bus network is available as regularly recoded by ATAC in the official balance sheets:

2001: 165.913.076 €

2002: 170.076.529€

2003: 178.981.781€

2004: 214.953.876 €

(please note that in october 2003 the cost of the tickes has passed from 0.77 to 1 €)

However such data were used to esteem the sold tickets trend for the whole transit fleet (see point c at M11)

- *Income from parking*: removed because not relevant to this task.

Evaluation category: *Environment*

- *Emissions of NOx*: substituted with C₆H₆ emissions because more relevant

- *Concentrations of NOx*: substituted with C₆H₆ concentrations because more relevant

Evaluation category: *Transport*

- *Reliability*: substituted with the Indicator "Daily availability of the vehicle":

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

In order to evaluate the effect of the introduction of a large number of Euro IV buses, an analysis campaign was deployed and given the high number of indicators several methods of measurements applied, it was necessary to repeat same procedures for both ex ante and ex post indicators values quantification, so to have homogeneity of results.

Energy indicators

There were no data useful to describe directly the baseline situation of the energy indicators, but those ones elaborated thanks to the ITEMS exercise. Ex post values were calculated by DITS from vehicles technical data provided by ATAC.

Environment indicators

Information on the fleet composition has been provided by ATAC in order to provide the emissions level of PT in the evaluation exercise.

Information on environment came from air quality assessments concerning the emissions of CO, particulate and benzene. In this case, for the ex ante evaluation, data from the HEAVEN project were used; in particular the TEE model, supplied by ENEA, calculated emissions due to traffic, processing parameters as traffic flows, composition of the car fleet and road network geometry.

For what concerns concentrations, indicators about CO, particulate and benzene were studied; moreover, before the start of the MIRACLES project, six monitoring campaigns on benzene concentration were carried out by radial diffusive passive samplers in a large number of measurements sites. In this way, a wide range of information about air quality at high spatial resolution was available. In particular, air quality data were acquired by the monitoring stations of the laboratory area, according to the methods indicated by 1999/30/EC and 2000/69/EC Directives. Benzene was measured by a passive samplers method: the Radiello® diffusive samplers; these are samplers in which the diffusive and absorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially and parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface. The BTEX, sampled in urban environment by the cartridge are thermally desorbed.

Since the enforcement on the law about the **noise pollution** is very recent, the gathering of quantitative data on noise was possible only on few spots; for this measure, surveys were run along Via Nomentana. Spot measurements were run on a 30 minutes basis, and repeated several times during the weeks. Measurement devices were Class 1 photometers, located 1,5 m above the ground level and 1 meter far from reflecting surfaces.

Society indicators

The methodology for the Customer Satisfaction Survey in MIRACLES was based on the analysis of Local Culture, integrated with the study of social events. The emphasis was put on linking processes of knowledge to processes of intervention and change. The survey used a theoretical model based on a psychosocial approach. According to this approach, emotional and collusive communication was realized through dense words. Studying the so-called "dense words" in the texts (by Emotional Text Analysis - E.A.T. methodology), it is possible to find

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collusive/cultural processes: specific ways used by single groups to build social relationship, based on recurring words with a “strong” emotional meaning (i.e. dense words). In particular, information was gathered based on focus groups and telephone interviews. The focus groups were based on sessions of 10 groups of 8-10 subjects, each lasting 90 minutes. The telephone interviews questioned 1,400 subjects (over 14 years old and resident in Rome). The subjects were grouped into cultural repertoires (previously identified) and also classified according to variables such as age, sex, profession, education, etc.

Transport Indicators

ATAC database on the fleet was fed by data collected during dedicated surveys provided data for both ex ante and ex post measurements; in particular for what concerns clean vehicles, data were provided by ATAC Technical Department periodic reports.

M9: Achievement of quantifiable targets:

One of the most important target achieved is that, compared to the beginning of the project, when most of the bus fleet was mainly composed of EURO 0 and EURO 1 Buses (78% today reduced to 12 %) and the average age of the bus fleet was of 12 years, thanks to a progressive introduction of cleaner buses during the past four years, nowadays the average age of the fleet is 5,75 years, and the bus fleet is mainly composed of EURO 3 Buses (over a total of almost 2.800 buses).

Further to this unexpectedly an important purchase of CNG buses is being pursued, thus now Rome can count over a 3% of ZEV (1,67 in 2001) and a 4% of CNG.

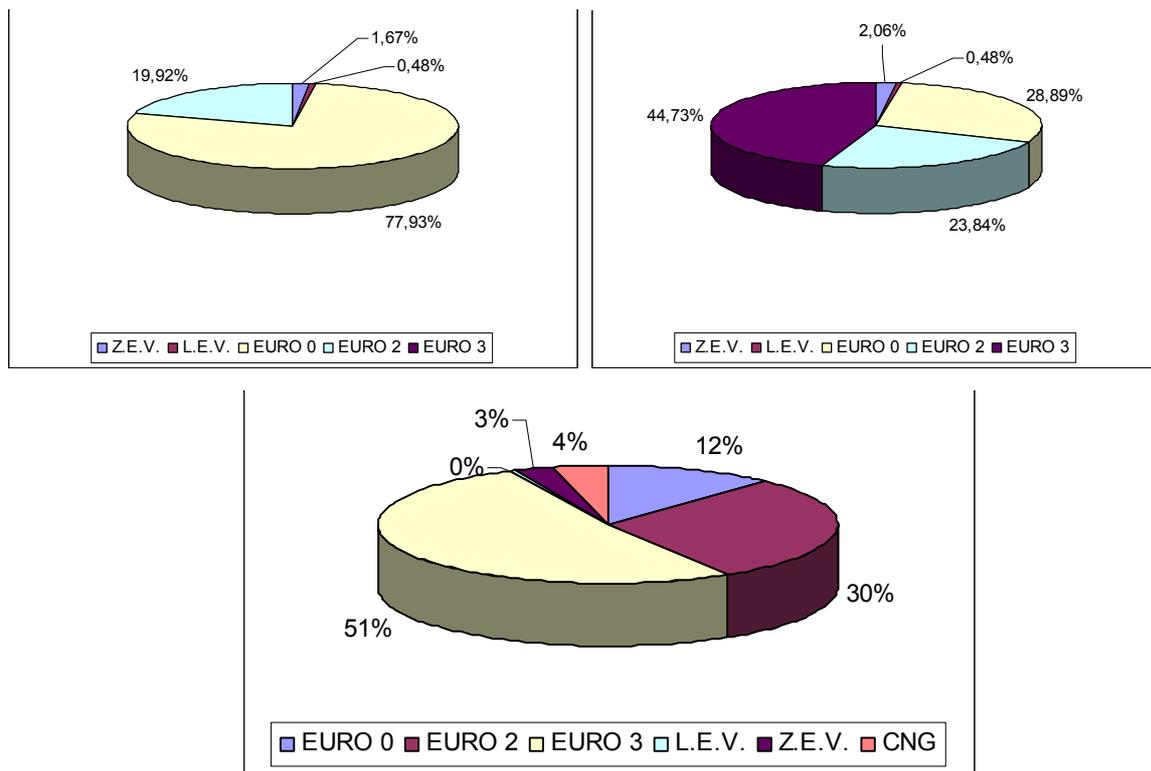


Figure4 – comparison between the composition of the fleet in 2001 – 2004 -2006

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedules and goals; in particular

Contribute to

- Increase e-vehicles PT fleet by 20% in the LTZ - by late 2005, 38% of the entire fleet is composed of new,

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eco-compatible vehicles;

- Reduce the number of polluting vehicles by 10% - 1107 Euro III buses replaced at least 44% of the previous fleet (mostly EURO O).
- Reduce transport related emissions by 5% - transport-related emissions reductions by 13% inside the LTZ [ref to WP5 also];
- Increase the replacement of old buses with e-buses by 25% - 52 e-buses + 30 trolleybuses, about 5% of the replacement;
- Reduce peak hours car traffic by 3% - Reduced by 20% during the whole restriction period and by 15 % in the morning peak hour (8.30-9.30) [ref to WP5 also];
- Increase modal shift from private cars to collective transport by 5% - Inside the Laboratory Area it has been recorded a 5% decrease in the use of private cars, mainly towards walking mode (3%) [ref to WP5 also];
- Increase the number of PT tickets sold by 1% (about 1 million more); achieved

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) Outcomes coming from the do something scenario, also called Miracles Scenario
- b) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- c) A comparison between quantifiable objectives and actual achieved results

a) The Miracles Scenario

Background

An important objective of Rome Municipality was hence to reduce traffic pollution through the renewal of the bus fleet not yet compliant with the European emission standards in force.

ATAC, with MIRACLES support, planned to substitute old buses to decrease average age of the fleet, to improve comfort and to reduce impacts on city environment. The average age of ATAC buses was in 2000 about 12. years.

30 trolley buses and 36 electric buses with zero emissions were to be soon introduced; besides, a fleet of 200 EURO III buses equipped with the CRT system was delivered in July 2004. The CRT is a trap for PM 10 (the most important traffic pollutant in Rome); this system allowed buses to have a significant reduction in the overall emission levels, such to perform almost the EURO IV standards.

At the end of 2003, bus fleet was composed of 2796 buses, shared in accordance with European standards, as shown in table 2. On a fleet of 2.796 buses 1.239 were EURO III buses. According to ATAC data, Trambus SPA managed about 120 millions of vehicles-km of PT service of Rome and about 20 millions vehicles-km were managed by SITA.

	<i>Trambus</i>	<i>SITA</i>	Total
<i>EURO 0 Buses</i>	404	-	640
<i>EURO 1 Buses</i>	9	108	108
<i>EURO II Buses</i>	853	156	746
<i>EURO III Buses</i>	1107	132	1239
<i>LEV (hybrid)</i>	12	-	12
<i>Electric buses</i>	51	-	51
	2400	396	2796

Table 1 – Bus typology in Rome in 2003

Methodology and results

The aim of this do-something simulation was the assessment of impacts, in term of vehicles emissions, due to the introduction of these new buses (30 trolley buses, 36 electric buses and 200 EURO III buses) in the Rome environment.

For the evaluation two scenarios and a series of assumptions were taken into account.

Since most of available data on PT supply referred to year 2003, this year was chosen for the reference scenario (*without measure*).

For the *with measure* scenario the substitution of 266 EURO 0 buses with 30 trolley buses, 36 electric buses and 200 EURO III buses was considered.

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The TEE software was used to perform pollutant emissions estimation.

Data on circulating vehicles and total distance covered by public transport buses are available on internet web sites of ATAC and Rome Municipality. Distance covered by each typology of bus (as for European standards) has been estimated proportional to relative fleet percentage.

Total distance covered by buses and average speed were supposed invariant for the two scenarios. Changes were in term of distance covered by each typology of bus.

In table 2 the percentage decrease of EURO 0 buses and the increment of EURO III buses after the introduction of new vehicles is reported. As expected, the corresponding decrease of pollutant can be observed in table 3.

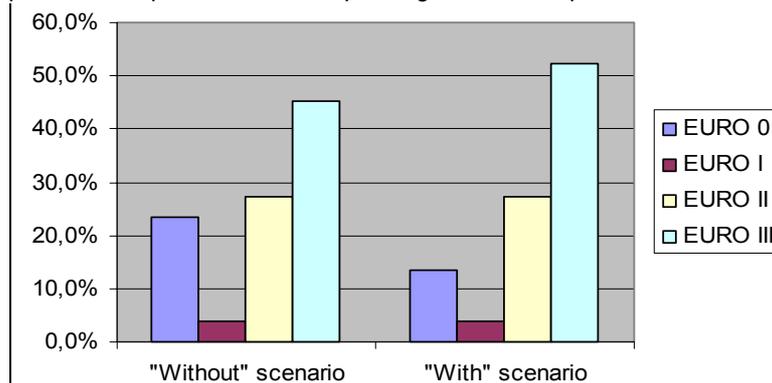


Table 2 – Percentages of polluting buses in simulated scenarios

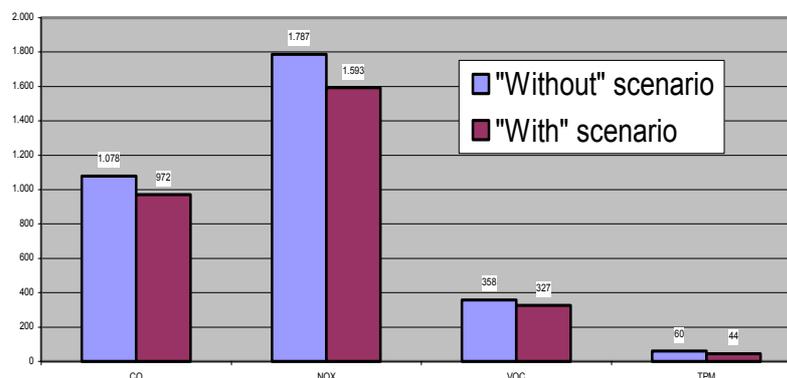


Table 3 - Estimated pollutant emissions (in tons) for simulated scenarios

b) The measure outcomes

Energy

Even though comparisons with the ITEMS simulation results are not fully appropriate, since ITEMS provided both for energy efficiency and vehicle efficiency only overall values, it is worth noticing a substantial reduction for both indicators due to trolleybuses as ex post values. The vehicle efficiency indicator shows a good reduction also for e-buses, whereas the energy efficiency seems to not meet expectations, being the value higher than the ITEMS forecasts. However, such apparently contrasting result is due to the modest capacity of each vehicle; indeed it must be reminded that e-bus capacity is 27 pass. The "small size" is however a must when the accessibility of the narrow streets of the city center must be supplied.

To explain the "Vehicle efficiency" different values between electric vehicles and diesel buses, it is worth remembering that the energy consumption of the latter pays low efficiency of combustion engines; on the contrary, for e-buses and trolleybuses it should be taken into account efficiency in the power generating plants, as well.

Environment

For both emissions and concentration surveys, even though observed that the main cause for the positive results in terms of pollution reduction were mostly due to WP5 measures, it is worth to report both ex ante and ex post values because the implementation of clean vehicles contributed to such improvements. Comments on these

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topics are reported in WPs 5, 6, 7 templates. The positive outcomes from the miracles scenario (Table 3) support such statements. The “rejuvenating” process of the whole fleet, however, affects in a very relevant way the emissions reductions, as stated in the 2004 Air Quality Report and as synthesized in the following table A:

Emissions of pollutants due to transit								
AREA	Pollutants (t/year)							
	CO		NOX		VOC		PM	
	2003	2004	2003	2004	2003	2004	2003	2004
LTZ	25	27	83	85	14	13	3	3
Rail Ring road	131	108	402	338	62	53	18	13
Metrop. area	274	230	850	721	131	114	38	28
Total	430	365	1335	1145	206	181	59	45

Table A - Emissions of pollutants due to transit

Most relevant results are achieved at Rail Ring Road area, where all emissions are reduced (PM – 28%; VOC – 15%; NOx – 16%; CO – 18%).

To assess the benefits arising from the implementation of the new vehicles, a survey monitored **traffic noise** before and after the implementation of trolleybuses, comparing the increase of noise due to the passage of a Euro 0 bus with that one produced by a trolleybus. Even though the “white noise” (i.e. the combination of all the sounds of all different frequencies in that given urban environment) was very high, a Euro 0 bus passing by increased such noise by about 10 dB(A). On the contrary, a trolleybus only increased it by about 5 dB(A). This represented a substantial reduction, especially considering that dB(A)s are measured according to a logarithmic scale. However, other factors also contributed, including the change of the road surface from block pavement to asphalt concrete.

Society

The qualitative relevance of lines operated by clean vehicles was confirmed by the appreciation showed by people. Awareness of the need to use clean transit increased from 53% to 76%, along with satisfaction which changed from 3.6 to 3.96 (1-5 Lickert scale), becoming the most “satisfactory measure” of the MIRACLES group.

Transport

To a quantitative improved service corresponded an impressive increase of passengers, so huge not to be comparable to the situation before MIRACLES. See template 7.3 for comments.

All results as described above for ex-ante and ex-post scenarios are reported in Table 4:

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Measure 12.1: Clean vehicles buses								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R12.1/Eco.1.a		Costs for maintenance (E/km)	0				a) 1 b)1,16 (first two years of service) 1,6 (after)	a) Electric buses b) Trolleybuses Diesel buses: the data cannot be provided since it is property of the company Trambus, which internally manages the maintenance of these vehicles
R12.1/Ene.1.a		Energy efficiency of transport modes (Mj/pkm)		0,1	0,1	0,1	a) 0,2 b) 0,08	a) electric buses b) trolleybuses ITEMS values for the whole clean buses fleet
R12.1/Ene.1.b	3	Vehicle efficiency (Mj/veh-km)		3,8	3,8	3,8	a) 3,6 b) 3,3 c)21,7 d)16,3	a) electric buses b) trolleybuses c) Diesel buses less then 5 years old: 0.6 l/km d) Diesel buses more than 5 years old: 0.45 l/km ITEMS values for the whole clean buses fleet
R12.1/Env.1.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R12.1/Env.1.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Base year and Ex-post value referred to Rail Ring Area Other values referred to Whole city
R12.1/Env.1.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour

Table 4- ex-ante and ex-post results in Rome: WP 12.1 Clean Vehicles

Notes:

(**) Mean normalised value of all the 57 monitored locations. See specific document in Air Quality Report. –

(***) The values of Villa Ada stations are not considered due to its use for the characterisation of the background air quality status of the city –

(****) Indicator useful only for a general assessment on the scenario

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Measure 12.1: Clean vehicles buses								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R12.1/Env.4.a	12	day/night level (dB(A))	L _{day} = 72 Law limit 65 dB(A)	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 68.5	Frozen and Trend values No variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS Ex-post value During these years, there was also an improvement of the paving.
R12.1/Soc.1.a	14	acceptance	No quantitative data available				Population 3.96 4.13 cluster1 4.18 cluster2 3.46 cluster3 3.89 cluster4 3.53 cluster5	
R12.1/Soc.2.a	13	Awareness (%)	53				76	
R12.1/Soc.3.a		Expectations towards involved agencies/bodies	No quantitative data available				Administration invests in satisfaction for the citizen: -75.6; +24,39; Administration invests in services: -40.99; + 59,01; Administration invests in production activities: - 7,66; + 92,34; Administration invests cultural heritage -13,55; +86,45	

Table 4- ex-ante and ex-post results in Rome: WP 12.1 Clean Vehicles (cont.)

MEASURE-LEVEL RESULTS

Measure title: Clean Vehicles - Busses

Project: Miracles

Measure number: 12.1

City: Roma

Measure 12.1: Clean vehicles buses								
1	2	3	4	5	6	7	8	9
MIRACLES number	METEOR number	Indicator (Units)	Base-year Value	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R12.1/Soc.3.b		Satisfaction level (Lickert scale point 1 to 5)	3.60				3.96	
R12.1/Soc.3.c	19	Use motivation	No quantitative data available				85 cluster1 73 cluster2 73 cluster3 80 cluster4 74 cluster5	
R12.1/Tran.1.a		routes (clean vehicles only)	1				5 lines by electric buses 1 line with trolley	No variations foreseen for frozen and trend scenarios
R12.1/Tran.1.b		travelled people (no./day) (clean vehicles only)	370				10000/12000 pax/day electric buses 32000 pax/day trolleybus	No variations foreseen for frozen and trend scenarios
R12.1/Tran.1.c		Daily availability of the vehicle (%)	n.a				Electric buses: 95% and more Trolleys (after 1 year): 85% Diesel buses less than 5 years old: 90% Diesel buses more than 5 years old: 85-90%	

Notes: cluster 1= control, cluster 2= confidence, cluster 3= anarchy, cluster 4= efficiency, cluster 5=mistrust

Table 4- ex-ante and ex-post results in Rome: WP 12.1 Clean Vehicles (cont.)

MEASURE-LEVEL RESULTS

Measure title: Clean Vehicles - Busses

Project: Miracles

Measure number: 12.1

City: Roma

c) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase e-vehicles PT fleet by 20% in the LTZ	By late 2005, 38% of the entire fleet was composed of new, eco-compatible vehicles, which lowered the average age of the fleet (from 12 to 5.75 years).	<i>Of the entire fleet: the electrical fleet increased with 10 new electric (+ 23% in comparison to the former small e-buses fleet) 30 trolleybuses (none before Miracles)</i>	☺☺☺
2) Reduce the number of polluting vehicles by 10% inside the LTZ;	1107 Euro III buses replaced at least 44% of the previous fleet (mostly EURO O)	<i>To be reminded also that: the number of non-catalysed vehicles e.g. non-catalysed mopeds reduced by about 45%, private cars by 37% and commercial vehicles by less than 35%.</i>	☺☺☺
3) Reduce public transport related emissions by 5%	transport-related emissions reductions by 13% inside the LTZ	<i>Most relevant results are achieved at Rail Ring Road area, where all transit emissions are reduced (PM – 28%; VOC – 15%; NOx – 16%; CO – 18%).</i>	☺☺☺
4) Increase the replacement of old buses with e-buses by 25%	52 e-buses + 30 trolleybuses, about 5% of the replacement.		☺
5) Increase the number of PT tickets sold by 1% (about 1 million more)	The number of PT single tickets sold (BIT) from 2002 until 2005 passed from 95.446.000 to 98.991.000		☺☺☺
6) Reduce private peak traffic flows by 3% in the LTZ	Reduced by 20% during the whole restriction period and by 15 % in the morning peak hour (8.30-9.30).		☺☺☺
7) Increase modal shift from private cars to collective transport by 5%	Rail Ring Area (where all the measures are implemented) showed a large decrease (5%) in the use of private cars in favour of walking (3%) and transit (1%).	<i>The five point decrease (percentage) for private cars in favour of one point increase (percentage) for transit was considered a noteworthy result, and suggested that citizens reduced their use of the car for trips of short distances.</i>	☺☺
<p><i>Caption</i></p> <p>☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level</p> <p>☺ difficult to assess ☺ not achieved</p>			

Upscaling - Status of the Measure beyond MIRACLES

The measure is currently operative and will continue beyond MIRACLES. Upscaling activities were already envisaged; indeed, plans to increase the number of trolley lines are already in the pipeline; concerning the electric buses, the idea is to implement new lines beyond the present LTZ system.

The engagement of the Municipality of Rome with the clean vehicles strategies is witnessed by the forthcoming introduction of the CNG buses.

Lessons Learned – what do other cities, other actors and the EC have to consider?

MEASURE-LEVEL RESULTS

Measure title: Clean Vehicles - Busses

Project: Miracles

Measure number: 12.1

City: Roma

M12: Barriers and drivers of the measure implementation / Process evaluation

During the implementation of the plan for fleet renewal, contingencies relevant contract awarding occurred, causing delays and re-writing of call for tender; in detail during 2002 the tender bid for 36 electric busses, 12 m. failed because no supplier submitted the tender.

Strong points of the traditional electric buses:

Flexibility - The vehicle's capacity to carry out the function foreseen in the framework of the network, namely the possibility of effecting the service inside the zones of the centre where the labyrinth of streets would not have permitted the use of larger vehicles,

Reliability - This result is also due to the choice made by ATAC of entrusting maintenance to the vehicle manufacturer itself, with a total servicing contract which has recently been renewed;

Good users' acceptance - The excellent reaction by the citizens at large

Weak points:

Autonomy - the batteries allow – also considering the characteristics of operation – an autonomy of about 6 hours, after which the vehicle has to be driven back to the depot where the run-down battery set is removed and replaced by another appropriately recharged one. The operation of disassembly and reassembly is simple and rapid, however the margin of autonomy inevitably implies a lack of flexibility in the organisation of the service, with the costs that this entails;

Capacity - The capacity of 27 passengers permits their utilisation exclusively on routes envisaging a limited load

Comfort - due to the absence of air conditioning, a problem felt more by the drivers than the passengers.

M13: Interrelationships with other measures

The task interacts strongly with measures 7.3 "Introduction of new lines", and with Work Package 5, Access Restrictions.

M14: Lessons learned

Especially concerning the electric vehicles, ATAC has learned a lot on the main aspect of the procurement, which is the reliability of batteries.

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22. Measure 12.3 – Support Services for clean vehicles

MEASURE-LEVEL RESULTS	
Measure title: Clean fuel support services	Project: Miracles
Measure number: 12.3	City: Roma
<i>The Measure – what is it about?</i>	
M1: Measure objectives:	
The task aims to: <ul style="list-style-type: none"> ● increase awareness and usage of electric scooters (or e-scooters); ● monitor the level of acceptance of the e-scooters; ● Implement new recharging stations for the scooters inside the Laboratory Area. 	
M2: Measure description:	
Award the management of the e-scooters fleet by the Municipality to ATAC with the aim of distributing the vehicles inside the LTZ, in order to enhance the use of electric powered vehicles in the city centre as well as to increase the level of awareness on ZEV vehicles.	
<i>The Implementation – how was the measure implemented?</i>	
M3: Innovative aspects:	
The enhancement of the electric fleet and more sophisticated approach towards their diffusion is the real innovative aspect.	
M4: Situation before CIVITAS:	
The Municipality of Rome was the owner of a fleet of 398 e-scooters made available for rental especially during the Jubilee year (2000). The fleet was acquired in order to promote the use of e-scooter in Rome. The Municipality of Rome exploited the funding to: <ul style="list-style-type: none"> ● Distribute the e-scooters for rental amongst strategic parking in the city centre; ● Provide financial support for purchase of e-scooters by citizens; ● Implement the batteries recharging stations. 	
M5: Design of the measure:	
The design of the task has been based on the following items:	
The Fleet.	
The Municipality has set up a plan to distribute e-scooters across the city. (Administrative units of the Municipality to be used for specific and repetitive trips in the urban area, and no-profit organisations, Universities, Local Health Units, etc).	
The recharging stations.	
The implementation of a network of recharging stations with 8 new stations has been designed.	
The awareness strategy	
A three-year strategy has been designed to increase awareness and usage of electric scooters according to the following: <ul style="list-style-type: none"> ● Focus on the positive environmental impacts; ● Provision of Municipality economic incentives for the citizens to replace pollutant two-wheels scooters with e-scooters; ● Municipality campaign “Amo Roma GUIDO ELETTRICO” allocating funds to boost purchasing of electric vehicles (bicycles, scooters, four wheels vehicles), as illustrated in Figure 1. 	

MEASURE-LEVEL RESULTS

Measure title: Clean fuel support services

Project: Miracles

Measure number: 12.3

City: Roma



Figure 1: campaign "Amo Roma GUIDO ELETTRICO"

M6: Actual implementation:

The first four recharging stations have been in operation since September 2002 and a second batch of 8 recharging stations has been activated in 2004.

During the four years of the Miracles project an allocation plan has been designed for donation to no profit organizations, Firms with Mobility Manager, Health centres and Hospitals, Municipal Companies etc. mainly located in the city centre.

The scooters have been allocated in three phases:

- 170 from February 2002 until September 2004,
- 171 since September 04 until August 05
- The last 50 within 31st October 05 have been allocated.

A call for tender (BANDO DI GARA N° 27/2005) has been issued in January by ATAC for the provision of 8 recharging stations, the adaptation of the already existing ones and maintenance of a total of 12 stations for 24 months, for a total amount of € 300.000,00, (€ 240.000,00 for provision e € 60.000,00 for maintenance).the tender closes on 20th February 2006.



Figure 2: a ceremony for the donation of the first group of scooters

ATAC were responsible for the maintenance both of the scooters and of the recharging stations as well as for the design of the second group of 8 recharging points. The distribution of the recharging stations is shown in Figure 3.

MEASURE-LEVEL RESULTS

Measure title: Clean fuel support services

Project: Miracles

Measure number: 12.3

City: Roma

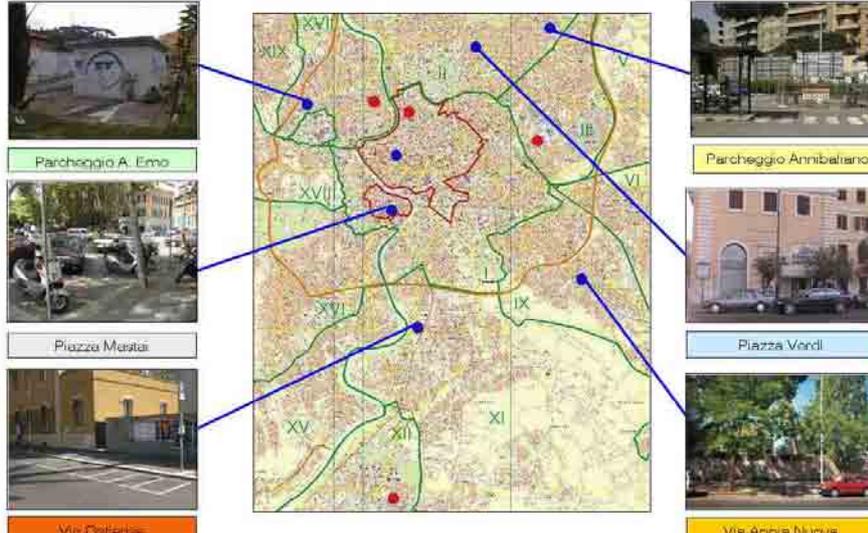


Figure 3: distribution of the recharging stations

M7: Deviations from the plan:

The delivery of the e-scooters has been slightly delayed compared to the initial plans, due to a delay in the supply of new batteries; anyway the delivery of the scooters has been completed by the end of October 2005.

Concerning the recharging stations, the timing has actually been exceeded, compared to the initial target, although the design has been completed, the realisation has been stopped by the administrative bureaucracy; these new 8 recharging points will be completed within March 06.

Indicators – Deviation from what planned in deliverable 4.1

Changes occurred because of two reasons: in general, some of the measures were slightly modified after the first amendment; this led to revise the list of indicators and to add/remove those indicators assessed as not anymore suitable to the amended measures; in some other cases, lack of available data made some indicators not usable.

For measure 12.3 deviations occurred to the following indicators:

Evaluation category: *Economy*

- *Investment costs*: added

Evaluation category: *Environment*

- *Emissions of CO/PM10/NOx*: removed because data not relevant to the measure implementation

- *Concentrations of CO/particulates/NOx*: removed because data not relevant to the measure implementation

The Evaluation – how was it done and what are the results?

M8: Method of measurement:

Economy indicators have been provided by ATAC, whereas the energy indicator was calculated by DITS according to vehicles technical specifications provided by ATAC

M9: Achievement of quantifiable targets:

Along with the introduction of 398 e-scooters in the day to day life of many firms/associations/Onlus, thanks to the incentives of the Municipality 200 individuals could buy an electric scooter.

M10: Achievement of evaluation-related milestones:

All the evaluation related milestones were achieved according to the implementation process and evaluation schedule; in particular

1. All of the scooters have been allocated according to the plans;
2. The Technical Specification for implementation of 6 recharging points is in the pipeline now;

MEASURE-LEVEL RESULTS

Measure title: Clean fuel support services

Project: Miracles

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City: Roma



Figure 4: a recharging station

M11: Report on the measure results:

Results reported in this paragraph are divided into the following sub-sections:

- a) The measure outcomes, according to evaluation categories and indicators and to the measure's general objectives, as stated in the Evaluation Plan, Deliverable 4.1 – Rome Annex
- b) A comparison between quantifiable objectives and actual achieved results

a) The measure outcomes

All the results for the ex-ante and ex-post scenarios are reported in Table 1 and described below.

This is a very niche measure, which could not be considered really affecting both emissions and concentration patterns, nor transport parameters, unless a wider implementation. Also costs for investments and for operating (theoretically divided per inhabitant) reflected the modesty of application, which – however – decreased after MIRACLES, thanks to a more rationalised management of the fleet. It is important to stress the promotion of alternative modes of transportation based on the incentives of the most popular ones (especially among the youngsters): the scooters.

Also for what concerns the energy indicator, the vehicle efficiency is just a quantitative parameter not so relevant as other specifications of the vehicle are, as autonomy, speed or recharging time, which can affect the users positive assessment.

Summary WP 12.3 Clean fuel support							
Indicator (units)		Baseline	Do-nothing (2006)		Miracles scenario	Ex-post	Note
			Frozen	Trend			
R12.3/En e.1.a	Vehicle efficiency (Mj/veh-km)	n.a	No	No	N/A	0,11	
R12.3/Eco n.1.a	Investment cost (€/inh)	2.507,63	No	No	N/A	0,56	
R12.3/Eco n.1.b	cost for operating (€/inh)	72,15	No	No	N/A	0,04	

Table1- ex-ante and ex-post results in Rome

N/A= data not available; No= no variation foreseen

** ITEMS Data or elaborated from ITEMS Results - Data provided by local partners;

For what concerns the environmental issues, even though e-scooters do not contribute to local pollution, it is worth reporting the 2003-2004 trend of emissions due to two wheels vehicles, in which an improvement in terms of emission reduction must be recorded as well for two main pollutants, as synthesized in Table 2, according to the 2004 and 2203 Air Quality Reports.

Emissions of pollutants due to two-wheels vehicles								
	Pollutants (t/year)							
	CO		NOX		COVNM		PM	
	2003	2004	2003	2004	2003	2004	2003	2004
Two wheels	22.298	26.085	109	191	8078	6.330	191	87

Table 2 - 2003-2004 trend of emissions due to two wheels vehicles

Positive results can be recorded for COVNM and dusts (respectively – 22% and – 50%), whereas CO and NOX

MEASURE-LEVEL RESULTS

Measure title: Clean fuel support services

Project: Miracles

Measure number: 12.3

City: Roma

slightly increased.

b) A comparison between quantifiable objectives and actual achieved results

Planned quantifiable objectives	Actual achieved results	Notes	Achievement rate
1) Increase e-vehicles recharging stations to 8 new locations	The Technical Specification for implementation of the recharging points is in the pipeline now	<i>Task delayed due to bureaucratic procedures</i>	☺
2) Reduce the number of polluting scooters by 1% in the LTZ	In 2001 there were 441.110 not cat. two wheels; in 2006 there are just 242.140 units (at whole city level); i.e.45% less	<i>Such value is qualitatively assessable for the LTZ</i>	☺☺☺
3) Increase share of e-scooters by 50% in the LTZ.	391 e-scooters (formerly for rental) are now at disposal for no profit organization. the municipality provided incentives to citizens to buyr 200 e-scooters	<i>The biggest barrier to the implementation is the limited autonomy of the batteries. They are well accepted if the purpose for the shift is well defined in time and space (max 10 km/day distance covered). Thus the desirable large scale level of usage could not be achieved.</i>	☹

Caption

☺☺☺ achieved far beyond forecasts; ☺☺ not fully achieved but still satisfactory outcome; ☺ achieved at a minor level
 ☹ difficult to assess ☹ not achieved

Status of the Measure beyond MIRACLES

The measure is currently operative. Results will be discussed at Municipal / national level after MIRACLES and the measure will be modified according to decisions that will be taken.

Lessons Learned – what do other cities, other actors and the EC have to consider?

M12: Barriers and drivers of the measure implementation / Process evaluation

The biggest barrier to the implementation of e-scooters in Rome is the limited autonomy of the batteries, which is an obstacle to the large scale use of these vehicles. It was found that people were happy with this new means of transport, but complain about the limited autonomy of the batteries.

Another difficulty is the implementation of recharging stations on the street, but the market is slowly improving.

M13: Interrelationships with other measures

Related with Access Restrictions.

M14: Lessons learned

Concerning the level of acceptance of the electric scooters, what has been figured out with the past experience is that: a) people do not like to rent scooters, Romans prefer the property; 2) the use of the electric scooters, since the autonomy is limited, as well as their speed is very low, they are well accepted if the purpose for the shift is well defined in time and space (max 10 km/day distance covered)

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23. City-level Results - Economy

CITY-LEVEL RESULTS	
Indicators title: Cost for operating, total income (E/inh.) Indicator numbers: 1 and 2 (METEOR Core Indicator #) Evaluation Area: Economy	Project: MIRACLES City: Rome
<i>The Indicator – what is it about?</i>	
C1: Local objectives and quantifiable targets:	
<p>Economy indicators were related to measures of WP5 (set up of city centre clean zone and Set-up of Green Corridors/zones), of WP6 (Road pricing policies and Adoption of flexible parking policies/Environmentally linked parking charges) of WP7 (7.1 Security and safety, 7.2.2 – On board information; 7.3 New lines – trolleybus, 7.4, Taxibus), of WP 8 (8.1.2 – Car sharing), of WP11 (11.1 Improved multi modal traveller service/Improving Network management) as well as to the measures on Mobility Management (10.2), clean vehicles (12.1) and on electric scooters (12.3). There were not direct quantifiable targets to assess the economical development of the whole set of MIRACLES measures, but the forecast technical achievement related to the increase of the number of PT tickets sold by 1% (about 1 million more) at City Level.</p>	
C2: Indicator description:	
<p>The indicator “total income” described all income coming from fares and tickets and/or passes; the indicator “Cost for operating” assessed the impact of the implemented measures in terms of costs charged to operators (or administrators); in particular it described all costs due to make a service available on yearly basis. Operating costs included, for instance, the personnel costs, fuel, electricity, etc. Usually operating costs include the maintenance cost, too, but for the MIRACLES study the latter was dealt (in some cases) as a self-standing indicator, because for some measures such costs seemed to be as relevant as the other operating ones. For the same reason, a new indicator, besides the METEOR core ones, was added: it was “investment costs” and it described all costs in charge to operators to start implementing a measure, in this case measures 11.1 and 12.3 which, at the base years, were in the trial phase, and hence only costs for starting the implementation were available.</p> <p>All the indicators are on yearly basis and they are, in general, referred to theoretical costs per inhabitant, so to provide “pro capita”, comparable costs for all the measures.</p> <p>Such palette of economic indicators provided the whole economic performance of the set of measures, and it was also linked to other transport indicators as average occupancies, passenger km, or vehicle km.</p> <p>In particular, “total income” was used to describe incomes coming from the implementation of measure 6.2 - Adoption of policies and environmentally linked parking charges (the indicator describes described the amount in € per parking place, thanks from data coming from the income statements of STA) and for measure 8.1 (amount of money coming from passes).</p> <p>Cost for operating was used for assessing all the measures with exception of 6.1 – road pricing policies, 9.1 - kerbside-doorstep delivery 10.1- awareness and 12.1 – clean buses. Financial information collected from the annual balance reports provided by the implementers, allowed to describe the cost in Euro per inhabitant of each measure. Different references were selected to define operation costs; for the baseline; for instance, in measure 10.2 the reported value was referred to the amount of money to implement the measure on its whole (i.e., the PT subscriptions financing provided by the implementer body to the Home to Work plan participants); for measure 11.1, for what, concerns the Telepay measure, the value was referred to the contribution paid by ATAC to the telephone company per each sold ticket during the Telepay trial.</p>	
C3: Context and relevance:	
<p>Indicators focusing on investment, operating, maintenance costs of the measures were particularly interesting because they represented the resources spent by the community to integrate the local mobility system with the new MIRACLES measures.</p> <p>Moreover, the addition of economic facts to the assessment of the measures in terms of impacts on environment, on transport, on energy consumption and eventually on society, made the overall evaluation of the measures more realistic.</p>	
<i>The Evaluation –what are the results?</i>	
C4: Method of measurement:	
<p><i>Ex-ante phase</i></p> <p>For the baseline, available data on this topic came from the information provided by the measures implementers and managers and by the 2000 UITP Millennium Database; for the former case, main data came from income statements of STA and from Rome Municipality databases, on the basis of annual balance reports; for the latter, both maintenance and operating costs were referred to the whole urban transportation system.</p>	

CITY-LEVEL RESULTS

Indicators title: Cost for operating, total income (E/inh.)

Project: MIRACLES

Indicator numbers: 1 and 2 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Economy

For the do-nothing simulation few economic data were required to run the ITEMS models, and these were referred to the following topics:

Topic: *socio- economic features of the city*

- GDP (*base year 1999*)
- Private consumption (or income per household only if savings are null)

Topic: *transport equipment of households*

- Value of time

Topic: *transport prices*

- Transport fares
- Average parking costs
- Road prices, toll prices *
- Transport costs
- Share of tax in price of cars, costs per km for cars (national data)
- Average price of cars (euro/car)

All provided facts came from databases of STA, ATAC and Rome Municipality, and from National Automobil Club statistics, as well. However, ITEMS did not provide direct values for any economy indicator for the do-nothing exercise (i.e. for baseline, frozen and trend scenarios).

For what concerns the do-something scenario, "total income" was calculated starting from data previously elaborated to build some general pricing scenarios, and hence using a traffic model. Because of the specific effects to be taken into account, the development of a tailored new model was considered preferable to a commercial standard tool. On the demand side, the pricing policies were considered to affect only some classes of users at different rates; on the supply side the charge was mode specific. A multimodal multi-user traffic assignment model was applied. The private and public transport graphs and the O/D matrices have been supplied by STA and elaborated by DITS (for details, see template 6.2).

For what concerns cost for operating, referred to the taxibus measure (7.4), this indicator was calculated by DITS by modelling the development of the operation for a three-years period.

Ex-post phase

In this phase data were collected in the same way of the baseline process so to have "before and after" homogeneous facts to compare.

C5: Achievement of quantifiable targets:

A comparison among indicators values, according to the ex ante and ex post phases is provided below (Table 1); values for the do-something scenario, developed for a single measure (6.1), are reported separately (Tables 2, 3 and 4).

CITY-LEVEL RESULTS

Indicators title: Cost for operating, total income (E/inh.)

Project: MIRACLES

Indicator numbers: 1 and 2 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Economy

MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Econ.1.a R5.2/Econ.1.a	2	Cost for operating the infrastructure (€/inh) referred all city pop.	2507,63*				0,34**	No variations foreseen for frozen and trend scenarios *Value referred to all city transportation system **Value referred implemented measure
R7.3/Econ.1.a	2	Cost for operating the infrastructure (€/inh) referred all city pop.	0				0,90**	No variations foreseen for frozen and trend scenarios **Value referred implemented measure
R5.1/Econ.2.a R5.2/Econ.2.a		cost for maintenance of infrastructure (€/inh) referred all city pop.	72,15*				0,10 **	No variations foreseen for frozen and trend scenarios *Value referred to all city transportation system **Value referred implemented measure
R6.2/Econ.1.a	1	total income from "pay for parking" (€/parking place).	380				430	No variations foreseen for frozen and trend scenarios
R6.2/Econ.2.a	2	cost for operating (€/parking place)	-				0.10	No variations foreseen for frozen and trend scenarios *Includes also cost for maintenance
R7.1/Econ.1.a		cost for maintenance of infrastructure (€/inh).	0				€ 25.000 / year € 0.0089 /inh.	The system has been implemented in 2003 No variations foreseen for frozen and trend scenarios
R7.1/Econ.2.a	2	cost for operating (€/inh)	0				€150.000 / year € 0.05 /inh	The system has been implemented in 2003 No variations foreseen for frozen and trend scenarios
R7.22/Econ.2.a	2	cost for operating (€/inh)	0				0,21	No variations foreseen for frozen and trend scenarios
R7.3/Econ.1.a		Cost for maintenance of infrastructure (€/inhab)	0				0,9	No variations foreseen for frozen and trend scenarios
R7.4/Econ.4.a	2	cost for operating (€/inh)	0,9				0.60 (16,48 Euro/user)	No variations foreseen for frozen and trend scenarios, do something value 1, 28
R8.1/Econ.1.a		cost for operating (€/inh)	0				0,005 (15000 total costs)	No variations foreseen in trend and frozen scenarios
R8.1/Econ.1.b		income (€)	0				20000	No variations foreseen in trend and frozen scenarios
R10.2/Econ.1.a	2	cost for operating (€)	7855,2				1.000.000 Euro/year, (24 €/part.)	No variations foreseen in trend and frozen scenarios
R11.1/Econ 3 a		Investment cost (€).	30000*				10.000 €/year	*trial lasted three months.
W11.1/Econ 4 a	2	cost for operating (€, Trial)	370*				30.000€	*trial lasted three months 0,1 € each sold ticket.
R11.2/Econ.1.a	2	cost for operating (€/inh).	0)*				0,05	* Not existing system No variations foreseen for frozen and trend scenarios
R12.1/Econ.1.a		cost for maintenance (€/km).	0				a) 1 b)1,16 (first two years of service) 1,6 (after)	a) Electric buses b) Trolleybuses
R12.3/Econ.1.b	2	Investments cost (€/inh)	2507,63				0,56	No variations foreseen for frozen and trend scenarios
R12.3/Econ.1.b	2	cost for operating (€/inh)	72,15				0,04	No variations foreseen for frozen and trend scenarios

Table 1 – Comparison between ex ante and ex post phases

Do- something scenario for the "road pricing measure"

The road pricing scheme was studied also according to do-something study, developed by DITS and fully described in the "Ex ante working note", available at the restricted area of the MIRACLES web site. In this paragraph, for the sake of conciseness, only the results of the introduction of a Road Pricing scheme in the morning and afternoon periods (i.e. the periods when the access restriction is currently operational) are shortly presented (Table 2). Results of the introduction of an evening scheme (i.e. in a period when the access is currently allowed to everybody) are described as well. Two cases are reported: the first one with reference to the summer period (Table 4), the second one to the winter period (Table 5). These two schemes are due the potentially significant differences that the demand could show in so different periods.

Schemes of the charging structure are reported for each table (Tables 3 and 6).

CITY-LEVEL RESULTS

Indicators title: Cost for operating, total income (E/inh.)

Project: MIRACLES

Indicator numbers: 1 and 2 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Economy

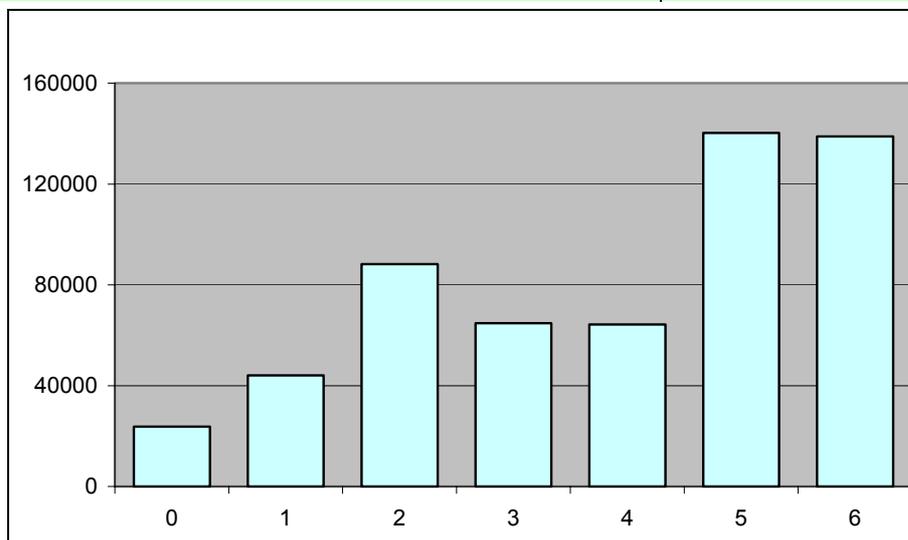


Table 2 - Daily revenues in scenarios 1 – 6 , morning and afternoon periods (6:30 – 18:00) (€)

		Users Category and main attributes						
		Residents car users		Not –residents, authorized car users		Mopeds users		Others
		charging structure	fare level (€)	charging structure	fare level (€)	charging structure	fare level (€)	PT supply) (average trip reduction)
Scenarios	0		Annual permit	300				
	1		Per trip	3			10%	
	2	Annual permit	300	Per trip	6			20%
	3			Per trip	1,5	Per trip	1,5	10%
	4			Per trip	1,5	Per trip	1,5	20%
	5	Annual permit	300	Per trip	6	Per trip	1,5	20%
	6	Annual permit	300	Per hour	1,5	Per trip	1,5	20%

Table 3 - Summary of simulated scenarios for revenues reported in table 2

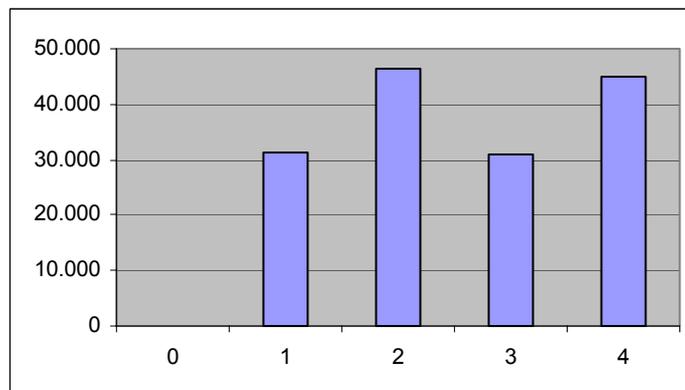


Table 4- Revenues from road charges, summer period (€/day)

CITY-LEVEL RESULTS

Indicators title: Cost for operating, total income (E/inh.)

Project: MIRACLES

Indicator numbers: 1 and 2 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Economy

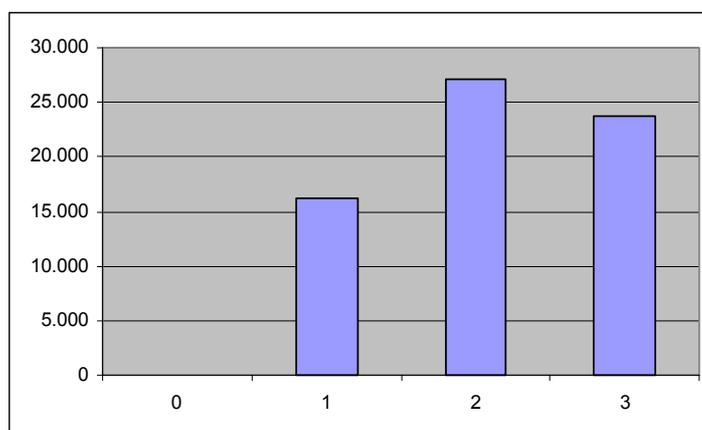


Table 5 - Revenues from road charges, winter period (€/day)

	<i>Scen. 0</i>	<i>Scen. 1</i>	<i>Scen. 2</i>	<i>Scen. 3</i>
Private cars				
<i>Charging structure</i>	-	Per trip	Per trip	Per trip
<i>Fare level (€)</i>	-	1	3	6
Public transport				
<i>PT supply (average trip time reduction)</i>	-	-	10%	20%

Table 6 - Summary of simulated scenarios for revenues reported in Tables 4 and 5

C6: Report on results:

Ex ante phase

Baseline and do nothing scenario

For what concerns the baseline year (2001), economic data provided a term of comparison for the do-nothing and the do something studies. For what concerns values provided for measures of WP5, available data were referred to the whole urban transportation system, so such comparison with the do nothing scenarios was run at the same general level.

In general, no variations for the economic indicators were foreseen for frozen and trend scenarios, starting from data provided to ITEMS and recalculated by DITS, because of the basic assumption of a modest socio-economics trend (due to the short period of simulation).

In particular, for "Cost for operating the infrastructure referred all city pop." (€/inh) no variations were foreseen both in trend and frozen scenarios because without infrastructural interventions cost for operating could not change relevantly, especially for measures 5.1, 5.2, 6.2, 7.1, 7.2 and 7.4. Given the peculiarity of measures 11.1, 11.2 and 12.3 (too short times or too little domain of application, uncertainties of participants, status of trial) no reliable do-nothing scenarios were possible. Moreover, no possible scenario was applicable for measure 10.2 because not proper assumptions on the number of participants eligible for subscriptions discounts could be made. Also for "costs of maintenance" no variations were foreseen both in trend and frozen scenarios because without interventions on infrastructure such costs could not plausibly change (as stressed above apropos of costs for operating), especially for measures 5.1, 5.2 and 7.1. With regards to "Investment costs" since measures 11.1 and 12.3 could be considered each as "one-off", and hence as not-to-be-repeated trials, they were not able to affect the do-nothing scenario.

Do something scenario

The Do-something scenario was developed to assess the amount of revenues coming from the measure in which charges were relevant facets of the implementation itself, i.e. pricing. From tables 2 and 3 it is easy to see that highest incomes could come from the heaviest scenarios in terms of charges (all users are charged, in scenario 5

CITY-LEVEL RESULTS

Indicators title: Cost for operating, total income (E/inh.)

Project: MIRACLES

Indicator numbers: 1 and 2 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Economy

the charge is 6 Euro per hour); for what concerns the potential daily revenues from the road charges in the summer hypothesis, it must be stressed that income would be notably higher in scenarios 2 and 4 than in scenarios 1 and 5, due to the fact that the fare level increase was significantly higher than the car number reduction, whereas in the winter hypothesis, expected revenues in scenario 3 were lower than in scenario 2, even though the level of charges was double, because the number of car users potentially subject to charges was much lower in scenario 2.

Another interesting result was achieved by the do-something simulation for collective taxibus. The indicator "cost for operating" shows an increasing of cost of service from 0,9 euro/inh to 1,28 euro/inh. This fact was due to the strong improvement of service that in baseline scenarios was used by about 190000 people in a year for a total amount of 2270 Km/day, whereas in the in do-something scenario it was used by more than 1 million people in a year for a total amount of 5724 Km/day

Ex post phase

The comparison of operating and maintenance costs for what concerns the measures of WP 5, before and after their implementation, was not completely reliable because as baseline reference only costs related to the whole urban transportation system were available, whereas after the implementation of the measures the single costs due to the implementation itself were at disposal. This can explain why the two sets of values differed so much, but in the same time it was possible to see how so relevant measures affect so modestly the overall budget: indeed, costs of operating and of maintenance per capita are minimal if linked to the general costs. However, it is interesting to note that if the operating/maintenance costs of the measures were theoretically divided per capita, there is a threshold which is just less than 1 Euro per inhabitant. Such result can be also confirmed from results related to costs for infrastructures and in particular from measure 7.3 – Trolleybus

No comparison, on the contrary, it was possible for those some measures which had no costs in the baseline, because not implemented yet (measures 7.1 7.2.2, 8.1.2 and 11.2). Unsuitable comparisons are also those ones referred to measures which, for the baseline, were at a trial or one-off status, whereas in the ex post phase are under full implementation (measures 10.2 and 11.1).

Lessons Learned – what do other cities, other actors and the EC have to consider?

C7: Lessons learned:

It is very difficult to define univocal benefits under the mere economical point of view. Indeed, the simple comparison before and after the implementation of measures shows variations in terms of more/less incomes or costs of mobility which are due to the different changes in the application of the MIRACLES measures. So a simple evaluation in terms of costs is not useful but it must be linked to other benefits due to the positive impacts of the measures on the environment, on the reduction of energy consumption, on the improvement of the transport patterns.

However, it is interesting to note that if the operating/maintenance costs of the measures were theoretically divided per capita, there is a threshold which is just less than 1 Euro per inhabitant. Of course, this value was not what users paid directly, but it is clear that for many measures, the wider the implementation, the greater the benefits for everyone.

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24. City-level Results - Energy

CITY-LEVEL RESULTS	
Indicators title: Energy efficiency of transport modes , Vehicle fuel efficiency (MJ/veh-km) Indicator number: 3 (METEOR Core Indicator #) Evaluation Area: Energy	Project: MIRACLES City: Rome
The Indicator – what is it about?	
C1: Local objectives and quantifiable targets:	
<p>The day by day increasing energy consumption is a top priority in the local administrators mobility agenda; in particular for Rome a way to find some solutions could be to pursue an approach based, not just on energy savings, but on the energy diversification, i.e. the implementation of new forms of vehicles such as electric buses fleet or e-scooters, along with a more traditional support of collective modes of transportation aimed at reducing fuel consumption caused by private cars. According to this approach, there were not direct quantifiable targets to reduce energy consumption.</p> <p>In detail, energy consumption indicators were related to measures of WP5 (set up of city centre clean zone and Set-up of Green Corridors/zones) as well as to the measures on Taxibus (7.4) and Car-pooling (8.1) and Clean Vehicles (12.1 and 12.3). Being developed a do-something scenario for the pricing measures (WP6), results achieved for measures of WP5 were considered applicable also to WP6 measures (Road pricing policies and Adoption of flexible parking policies/Environmentally linked parking charges).</p>	
C2: Indicator description:	
<p>The indicator “Vehicle fuel efficiency” measured the fuel used per vehicle km, per vehicle type (MJ/veh-km); The indicator “Energy efficiency of transport modes” described the fuel used for transporting passengers ((MJ/pkm). Efficiency meant the energy consumption per unit of transport activity (MJ/vkm), and by type of vehicle.</p>	
C3: Context and relevance:	
<p>Given the general objective, i.e. to provide a comparative evaluation of the energy used at the city level to fulfil the mobility requirement, for the city of Rome it was very interesting to assess the overall energy efficiency level thanks to the improvements caused by the MIRACLES measures. It is important to stress that this survey was also relevant, since till now no specific researches, in which the link between energy consumption and sustainable mobility measures at urban level, were run. On the contrary, at national level historical data on the energy efficiency of transport modes (in MJ/pkm) were available. The methodology to determine such data was based on the process of information, data and figures coming from the National Transport Statistics Report (yearly published), from historical data on energy consumption provided by National Petrol Union, and from the CORINAR method. According to these sources, most efficient modes, at national level, are undergrounds and tramways. Given the “national” status of such survey, collective innovative modes as taxibuses or car sharing are missing; so in this case the MIRACLES test could be used as a pilot experience at local level.</p>	
The Evaluation –what are the results?	
C4: Method of measurement:	
<p>As stressed in the C3 section, no specific data on “Vehicle fuel efficiency” and on “Energy efficiency of transport modes” were available for Rome, as baseline reference.</p> <p>However, the two indicators were studied starting from data provided to the ITEMS exercise. Indeed, data to determine the energy efficiency in general, were based on fleet composition, vehicle utilisation in terms of mileage, along with other characteristic as average speed and trips, etc. Attention was paid in utilising the same classification for vehicles, so to be consistent with the one used for the emissions assessment.</p> <p>In particular, relevant data provided to ITEMS were:</p> <p>Topic: transport equipment of households</p> <ul style="list-style-type: none"> • Car equipment: owned or at disposal (<i>base year 1999</i>) • Number of registration of new vehicles (<i>1980 to 2001 provincial data</i>) • Number of cars per fuel type and engine size (<i>national data</i>) • bus (urban + school bus) – per company, registered in the city • buses and coaches (<i>national data</i>) • Trucks (<i>national data</i>) • Light vehicles (< 3,5 tons) (<i>national data</i>) <p>Topic: energy consumptions</p> <ul style="list-style-type: none"> • Sales of energy within the urban area • Annual average mileage of vehicles (<i>national data</i>) • Average consumption of vehicles (<i>national data</i>) <p>Topic: technology</p>	

CITY-LEVEL RESULTS

**Indicators title: Energy efficiency of transport modes ,
Vehicle fuel efficiency (MJ/veh-km)**

Project: MIRACLES

Indicator number: 3 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Energy

- specific fuel consumption per veh-km (*year 2001- national data*)
- share of cars submitted to emissions standards (*in accordance to CORINAIR/COPERT*)
- share of trucks and buses submitted to emissions standards
- fuel specifications

ITEMS provided values for the two indicators for the do-nothing exercise, i.e. for the baseline, frozen and trend scenarios.

Eventually, starting from the ITEMS results, the value of “Energy efficiency of transport modes” for measures 7.4 and 8.1 was re-calculated by implementers, dividing “Vehicle fuel efficiency” with the average occupancy rate for type of service. This was necessary to adapt the same indicators to measures 7.4 and 8.1, given the different size of the vehicles used in the two measures. Also for what concerns measure 12.1 there were no data useful to describe directly the baseline situation of the energy indicators, but those ones elaborated thanks to the ITEMS exercise. Ex post values were calculated by DITS from vehicles technical data provided by ATAC.

For what concerns the do-something scenario, fuel consumption was calculated for the measure “Road pricing policies”, using the TEE model. Such indicator was calculated along with emissions rates; results provided the percentage variations of impacts, in terms of consumed fuel, according to different pricing scenarios. The variation was calculated making the difference between scenario 0 (do-nothing) and scenario x (one of the pricing scenario), dividing it to scenario 0 and making the percentage. To determine the values for each scenario, the model combined data of average speed, trip time and fuel consumption per different users classes.

C5: Achievement of quantifiable targets:

A comparison among indicators values, according to the ex ante and ex post phases is provided below (Table 1); values for the do-something scenario, being developed for a single measure, are reported separately as a comparison between do-nothing (0) and do-something scenarios (1-6, different per increasing charges) (Table 2).

Ex ante (do something scenario excluded) – Ex post phases

Energy indicators – Fuel consumption									
MIRACLES number	METEOR number	Indicator (Units)	Value base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes	
R5.1/Ener.1.a R5.2/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)	1)0,9 2)0,1	1) 0,9 2) 0,1	1)0,8 2)0,1	1) 0,65		1)private car 2)PT	
R5.1/Ener.1.b R5.2/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)	1)1,1 2)3,8	1) 1,1 2) 3,8	1)1,0 2)3,8	1) 0,53		1)private car 2)PT	
R7.4/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)	0,46	0,46	0,42	0,0000376 (liter/pkm) $7,07 \cdot 10^{-4}$ (MJ/pkm)		Values rielaborated from data provided for ITEMS and/or from ITEMS results	
R7.4/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)	1,1	1,1	1,0	0,0055 (liter/veh-km) $1,035 \cdot 10^{-2}$ (MJ/veh-km)			
R8.1/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)	0,36	0,36	0,33	$1,9 \cdot 10^{-4}$ MJ/pkm			
R8.1/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)	1,1	1,1	1,0	0,028 MJ/veh-km			
R12.1/Ener.1.a		Energy efficiency of transport modes (MJ/pkm)	0,1	0,1	0,1	a) 0,2 b) 0,08		a) electric buses b) trolleybuses	
R12.1/Ener.1.b	3	Vehicle fuel efficiency (MJ/veh-km)	3,8	3,8	3,8	a) 3,6 b) 3,3 c)21,7 d)16,3		ITEMS values for the whole clean buses fleet a) electric buses b) trolleybuses c) Diesel buses less then 5 years old: 0.6 l/km d) Diesel buses more than 5 years old: 0.45 l/km	
R12.3/Ener.1.a	3	Vehicle efficiency (MJ/veh-km)				0,11		ITEMS values for the whole clean buses fleet	

Table 1 – Comparison between ex ante and ex post phases

CITY-LEVEL RESULTS

**Indicators title: Energy efficiency of transport modes ,
Vehicle fuel efficiency (MJ/veh-km)**

Project: MIRACLES

Indicator number: 3 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Energy

Do- something scenario for the “road pricing measure”

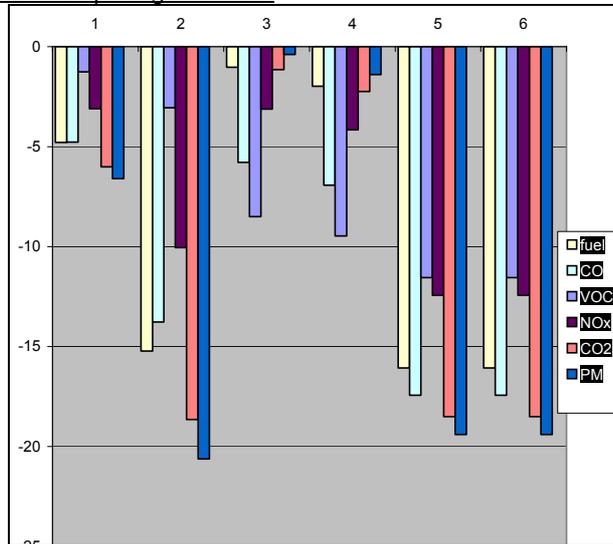


Table 2 - Percentage variation of impacts in scenarios 1 – 6 (fuel, in yellow and emissions)

C6: Report on results:

Ex ante phase

Baseline and do nothing scenario

If the baseline values for both indicators (Energy efficiency of transport modes and Vehicle fuel efficiency) are considered, by the comparison with the frozen and the trend scenarios values, no significant difference was detected, for measures of WP 5. In detail, for what concerns private cars a very minor variation was reported for the trend scenario (a 0.1 decrease in comparison to frozen and baseline situations), whereas for the PT system there were no variations at all. Starting from the general ITEMS results, the recalculated values of both indicators showed minor variations in this case too: a 0.2 decrease in the trend scenario is reported for measure 7.4 and a 0.3 decrease for measure 8.1 for the same scenario.

Do something scenario

The do-something scenario showed an interesting result for what concerns its application to the road pricing measure. Given six scenarios (1-6 in which the charges become progressively higher and thence more restrictive for drivers), the consumed fuel rate is higher in the “cheapest scenario”, and consequently lower as the more expensive scenario is considered. This can be explained in terms of varied modal split, whose changes corresponded to different fares: as expected, transit progressively increased and cars strongly decreased as charges increased. This can be roughly synthesized: the less circulating cars can be achieved, the more fuel for private cars is saved.

Ex post phase

Generally speaking, both the indicators “Energy efficiency of transport modes” and “Vehicle fuel efficiency” showed strong decrease which was due to the improved modal split, in which transit and walking increased, and to the reduced number of circulating polluting vehicles; the latter due to a renewal of the private cars fleet, as a consequence of national funding to incentive less polluting vehicles.

Both values were theoretically determined, processing 2004 data on the gas and diesel consumption (in g/h) according to several parameters, among the others: the circulating fleet, average occupancy and the vkm rates, provided by STA. However, STA observed a descending trend for what concerns fuel consumption since 1999. All these assumptions led to estimate a very strong reduction for what concerns the “Vehicle Fuel Efficiency”, which is virtually the half of what assessed as baseline value, and an appreciable decrease of “Energy efficiency of transport modes”, about 17%.

Energy consumption for niche measures as collective taxis (measure 7.4) or shared use of vehicles (measure 8.1) were not comparable to the overall values, because of the modesty of the number of involved vehicles.

For what concerns clean buses, even though comparisons with the ITEMS simulation results are not fully appropriate, since ITEMS provided both for energy efficiency and vehicle efficiency only overall values, it is worth noticing a substantial reduction for both indicators due to trolleybuses as ex post values. The vehicle efficiency

CITY-LEVEL RESULTS

**Indicators title: Energy efficiency of transport modes ,
Vehicle fuel efficiency (MJ/veh-km)**

Project: MIRACLES

Indicator number: 3 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Energy

indicator shows a good reduction also for e-buses, whereas the energy efficiency seems to not meet expectations, being the value higher than the ITEMS forecasts. However, such apparently contrasting result is due to the modest capacity of each vehicle; indeed it must be reminded that e-bus capacity is 27 passengers. The “small size” is however a must when the accessibility of the narrow streets of the city center must be supplied.

To explain the “ Vehicle efficiency” different values between electric vehicles and diesel buses, it is worth remembering that the energy consumption of the latter pays low efficiency of combustion engines; on the contrary, for e-buses and trolleybuses it should be taken into account efficiency in the power generating plants, as well.

Also for what concerns the electric scooters energy indicator (measure 12.3), the vehicle efficiency is just a quantitative parameter, neither comparable to other measures’ transport mode nor so relevant as other specifications of the vehicle are, as autonomy, speed o recharging time, which can affect the users positive assessment.

Lessons Learned – what do other cities, other actors and the EC have to consider?

C7: Lessons learned:

It is very difficult to determine data on fuel consumption at local level because neither target groups for consumption data (vehicles manufacturers, fuel producers and distributors, national Automobile Clubs, PT operators, environment protection agencies, goods transport associations, etc.) nor target groups for vehicle fleet data (PT operators, traffic control authorities, insurance companies, national Automobile Clubs) have at disposal comparable information. Indeed, some bodies collect data at national level, some others at provincial level, a few others at local level. The homogenisation process becomes difficult and time-consuming and the acceptability of such derived facts becomes tricky. On the other hand, the relevance of the knowledge of consumption rates is unavoidable, when real upgrading processes towards more sustainable habits are wanted. Such rates are as important as the emissions ones, so for a city as Rome the continuous survey on the fuel consumption issue should become a target.

However, as results of the whole bunch of restrictive measure applied on the Laboratory area, it is to stress the very strong reduction for what concerns the “Vehicle Fuel Efficiency”, and an appreciable decrease of “Energy efficiency of transport modes”. Troelleybuses can be awarded as the best performers in this field.

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25. City-level Results - Environment

CITY-LEVEL RESULTS	
Indicators title: Emissions, Concentrations, Noise level Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #) Evaluation Area: Environment	Project: MIRACLES City: Rome
<i>The Indicator – what is it about?</i>	
C1: Local objectives and quantifiable targets:	
<p>Measures concerning the set-up of clean zones and green corridors in the city centre, the adoption of policies and environmentally linked parking charges, introduction of PT new lines, new services and of more eco-friendly vehicles aimed at reducing both directly (measures as clean vehicles) and indirectly (as access restrictions) emissions and concentrations. So indicators on air quality in general were taken into account by Miracles for their relevance to describe the success/the failure of a given measure.</p> <p>These indicators, hence, were targeted to assess whether the pollutant values after the implementation of the set of measures within the Miracles Demonstration project changed.</p> <p>Along with the improvement of the air quality level another important indicator was the noise level; indeed, decrease/increase of traffic and the quality of traffic itself affect the overall noise level. Moreover, national law on Acoustic Recovery Plan (Law nr. 447/95) enforced new noise limits for the different urban areas. According to this point of view, the noise level indicator was aimed at verifying whether law requirements were met or not thanks to the implementation of the set-up of city centre clean zones and of green corridors zones, the time based entrance/ road pricing policies, and the Clean vehicles buses.</p> <p>Within the Evaluation Category “Environment”, another indicator linked to the air quality level was: number of polluting vehicles on the network. This indicator reported the decrease of non catalyzed cars, following the restriction to accessing the city central area to non-catalyzed private vehicles and the opportunity for a renewal of the PT fleet.</p> <p>At the end of the MIRACLES Project, expectations were to reduce by 13% (inside the ZTL) and by 5% (in the remaining parts of the Laboratory area) the emissions related to transportation, as well as to replace at least 25% of the PT fleet with Euro III standard and electrical vehicles.</p> <p>Both in the do-nothing and the do-something scenarios air quality variations were studied; moreover, an in-depth comparison between before and post MIRACLES Measures was run, as part of a dedicated methodology. Do nothing scenario was partially derived from ITEMS. (see sections C3 and C4).</p>	
C2: Indicator description:	
<p>The indicator on emissions was actually divided in three indicators, i.e.:</p> <ul style="list-style-type: none"> emissions of CO(kg/h and kg/day) emissions of particulates (kg/h and kg/day) emissions of C6H6 (kg/h and kg/day) <p>These indicators described the amount of the related pollutant on hourly/daily basis</p> <p>The indicator on concentrations was actually divided in three indicators, i.e.:</p> <ul style="list-style-type: none"> concentrations of CO (millig/m3) concentrations of particulates (microg/m3) concentrations of C6H6 (microg/m3) <p>These indicators described the amount of the related pollutant.</p> <p>The indicator “noise level” described the level of noise in dB(A), during daytimes and nighttimes, to be compared to the law requirements.</p> <p>The indicator “polluting vehicles” reported the number of polluting vehicles circulating per year.</p>	
C3: Context and relevance:	
<p>The joint application of several measures targeted to control private traffic, both in terms of accessibility and in terms of eco-friendliness, and to upgrade the PT system, affects positively the urban environment. Indicators to measure benefits from this upgrading process were needed, and in particular those ones useful to describe pollution levels; they could be also taken into consideration for evaluating consequences due to exposure to air pollution, mainly for what concerns health diseases, damages on vegetation and on the cultural heritage. However, this was not the only reason why local evaluators together with local partners decided to select indicators on concentrations and on emissions. Besides scientific motivations, such indicators were already in use in Rome to report the annual air quality status; so the selection of these indicators was perfectly consistent with the surveys on the environmental situation of Rome, especially if historical trends of emissions and concentrations rates are to be studied. Generally speaking, among all the parameters taken into consideration, the worst situation, in past times, concerned dusts: indeed, for particulate (mainly PM10) the value was very high and over</p>	

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

the national quality standard (40 µg/m³) and over the European standard (20 µg/m³), as well. The reasons of such bad performance could be linked to weather conditions and to traffic. The former, because of long winters with few rainy days and lack of winds, helped in keeping pollution levels high, but it was the latter, that, above all, affected negatively the air quality: indeed, in the past, the massive use of private cars, the high amount of non catalyzed cars and old buses and, on the contrary, the extremely low number of eco-friendly vehicles, and in the end old generation mopeds and motorcycles were the main factors of pollution. Table 1 reports a qualitative profile of the trend of CO and C₆H₆ emissions (years 1999 – 2000), in a working day, in which a slight positive decrease of pollutant factors is showed, mainly because of the increasing number of clean vehicles.

Working day – Average Kg	1999	2000
CO	136,745	131,520
C ₆ H ₆	878	835
1999 Year Average in g/m ³		
PM10	51,2	

Table 1. - Average emissions in Rome
(source: Rome Municipality, STA, 2001. Yearly Report on traffic emissions in the city of Rome)

For what concerns noise, it can be said that up to the issue of the national law on urban acoustic recovery, no surveys on regular basis were run to check this aspect; in the very next period of enforcement of the law, noise levels on the whole urban area were highly above to what allowed. Such situation was quite unchanged up to the MIRACLES baseline survey because of difficulties on the enforcement of the law and to intervene on the noise sources.

Also the situation of the polluting vehicles was not positive in past years. Most of the private vehicles were quite old, low efficient and highly pollutant, as shown in Table 2; this aspect became particularly severe in the city center where pollution affected negatively not only citizens' health but also the state of conservation of historical monuments.

Four wheels	(in %)			
	GAS		DIESEL	LPG and Methane
	non catalytic	catalytic		
cars	42.4	41.83	13.17	2.6
commercial vehicles	21.8		78.2	
Two wheels	(in %)			
	Conventional		Euro 1	
motorcycles	65		35	

Table 2 - Rome area vehicles fleet size, according to the used fuel (year 2001)
(source: Rome Municipality, STA, 2001. Yearly Report on traffic emissions in the city of Rome)

Old generation mopeds and motorcycles, as shown in Table3, were the main pollutant vehicles. Mopeds are the most popular mode of transport among Roman teenagers, since they represent a very low cost way of "getting around" (but such a trend is nationwide, since the 51% of all the European mopeds are sold in Italy).

Rome Municipality area mopeds fleet size		
vehicle category	no	%
Conventional	314,721	93
Euro 1	23,278	7
total	337,999	100
source: ISTAT - National Institute of Statistics		

Table 3 - Motorized two wheels fleet size (year 2000)

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

Rome Municipality area motorcycles fleet size				
	Conventional		Euro 1	
vehicle category	no.	%	no.	%
< 250 cc	73,947	42	40,868	23
250<cc<750	40,386	23	7,180	4
>750 cc	12,056	7	2,330	1
Total	126,389	72	50,378	28
source: ACI Automobil Club d'Italia				
total of motorized two wheels vehicles: 514,766				

Table 3 - Motorized two wheels fleet size (year 2000)

All these factors started slightly to decrease after the beginning of 2000, also in accordance to the national trend; the reasons of it relied on the benefits coming partly from some already implemented spot measures and partly from other national policies such as those, as the auto scraping (a bonus was granted for old cars scraped and for the contemporary purchase of new ones) or the law on the access restriction for non catalyzed cars, aimed at a global renewal of the private cars fleet.

The Evaluation –what are the results?

C4: Method of measurement:

Baseline

Emissions indicators: Particulates, CO (and C6H6)

Data came from test results obtained by models, mainly at city level; in particular, pollution impacts were described by the TEE model that allowed to calculate emissions due to car traffic starting from information and data concerning traffic flows, composition of the car fleet and road network geometry. Emissions and concentrations data were published in the 2001 Air Quality Report.

Concentration indicators: Particulates, CO (and C6H6)

The ADMS - Atmospheric Dispersion Model System, allowed to calculate concentrations values at local level; nevertheless, results were integrated with extra data coming from direct measurements operated by Rome Municipality's Department of Environment.

Polluting vehicles

For baseline, frozen and trend scenarios data were taken from ITEMS results, on the basis of statistical data provided by the local partners to the METEOR questionnaire, and divided according to circulating vehicles per kind of fuel used and maximum load of vehicles. This indicator had a twofold scope: on one hand, it provided quantitative data on the situation before the enforcement of circulation restriction to not-catalysed vehicles and the institution of the mopeds check-up; on the other, it helped defining the emissions and concentrations rates in the whole laboratory area of MIRACLES, mainly for what concerned measures of WPs 5 and 6.

Noise level

It is based, when possible, on spots surveys. The process for elaborating the data was very difficult and in some cases night surveys were not available; however a possible solution for the measures where the night/day levels were not recorded could be to assume as data the limits set by the national law on acoustic recovery plan for urban areas, i.e. 65 dB(A) daytimes and 55 dB(A) nighttimes.

One example of survey on spot is reported in figure 1. Such surveys were performed according to the law on the Acoustic Recovery Plan specifications: i.e. all measurements were run on the spot and each one lasted at least 30 min. For every spot, the measure was repeated in different days. According to the Acoustic Recovery Plan law, a class 1 phonometer was used, located at 1,5 m. above the ground and at least at 1 m. from any reflective surfaces.

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

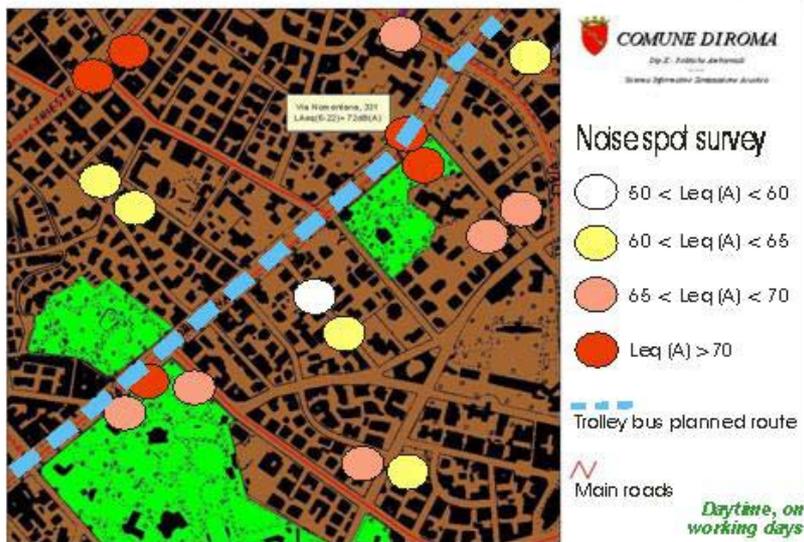


Figure 1 – Spot surveys along the Trolleybus planned route

Do-nothing

To evaluate the variation of indicators of emissions in Do-nothing scenarios, the ITEMS model was used. ITEMS was the so-called custom-tailored tool for the production of estimations; it is, hence, a model to evaluate and support decisions on policy measures in the field of urban transport, focused in energy efficiency and environment. It could assess technologies and policies in terms of their effects on energy, environment and economy. Big efforts were spent to adapt any available information to the input data requested by the model.

In particular, as explained below, results provided by ITEMS were also revised to homogenize them with the units used for the baseline values.

The data situation of the city, allowed ITEMS to provide two different versions of the “do-nothing” scenario:

- A “Frozen” version
- A “Trend” version, according to METEOR (2003) ‘D2 – ‘Assessment framework and evaluation guidelines for data collection’ and METEOR (2003) ‘D3 – ‘City reference for evaluation’

Emissions of Particulates and CO (and C6H6)

Emissions of CO and of particulates in ITEMS study were expressed in t/year. To change these data in kg/days so to be comparable to baseline data provided by local partners, values were divided for number of days in year (364). To obtain kg/hour in peak hour, the daily emission was divided by seven, since this was the proportion factor observed between daily and hourly emissions.

For what concerned Benzene, since ITEMS didn’t provide data on this pollutant, emissions were calculated by a linear progression, taking into account values edited in the Rome Municipality Air Quality Report, years 2001 – 2003.

Pollutant vehicles

The indicator was provided by the ITEMS exercise; variations were detected only for some classes of vehicles.

Concentrations of Particulates and CO (and C6H6)

Concentration of pollutant were not provided by ITEMS, given the difficulties of calculations. Indeed, to have such data, models processing multi-information, such as for instance a 3D scheme of the built environment, would be the more appropriate tools. However, a more approximated, easier way to calculate them was run taking into account variations surveyed in years 2002 and 2003 in Rome by ARPA Lazio (Lazio Region Environmental Protection Agency). The year 2006 data was hence calculated by the assumption of a linear variation, for the trend scenario.

Noise level

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level

Project: MIRACLES

Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Environment

No data were provided by ITEMS; however the progressive enforcement of law nr. 447/95 (Acoustic Recovery Plan), allowed to forecast for the year 2006 a day level of 65 dB(A) and a 55 dB(A) night level, at city level.

Do-something

To evaluate the impacts of the measures implemented within the MIRACLES project a “do-something” scenario simulation was performed.

Measures were analyzed separately in order to determine the impact related to each single implementation, then package of measures had to be defined in order to evaluate the combined impact of several measures.

Simulations referred to the morning peak hour, since this period was the worst condition in terms of congestion and pollution.

The impacts were estimated in terms of benefits (e.g. emissions, traffic congestion, road safety, PT usage) on the whole MIRACLES’ Laboratory Area.

To perform scenarios simulations (one for each measures) a specific traffic simulation programme, TransCad was used, to develop specific models as modal share model.

TransCad is a full-featured Geographic Information System (GIS) designed specifically for planning management, and the analysis of transport systems.

Therefore, the use of TransCad and its specific models, allowed to perform scenario simulations aiming at evaluating the impacts of:

1. new access regulatory acts;
2. new access control systems (both for simulating impacts related to measure: (5.1 set up of city centre clean zones)
3. different road pricing policies (to simulate measure: 6.1 road pricing policies)
4. introduction of different parking tariffs (to simulate measure: 6.2 flexible parking policies)
5. Low emission buses and new line (to simulate measures: 7.3 new line and 12.1 clean buses)

For what concerns emissions, related impacts were calculated using the TEE software. The calculation was made using the vehicle-km variation (for different modes) due to the introduction of a given measure. For instance, the application of the TransCad and TEE softwares allowed to determine the average length of trips within an area so benefits, in terms of emissions reduction, could be determined.

Ex-post

Emissions of Particulates and CO (and C6H6)

Data came from test results obtained by models, mainly at city level; in particular, pollution impacts were described by the TEE model, as for the baseline data.

Concentration of Particulates and CO (and C6H6)

The air quality data were acquired by the monitoring stations, located in the Laboratory Area (“Railway Ring”) in Rome, according to the methods indicated by the Directive 1999/30/EC and Directive 2000/69/EC. The Radiello sampler was used to acquire data on pollutants concentrations. As stressed in the measures templates, the “Radiello®” sampler is a diffusive sampler in which the diffusive and adsorbing surfaces are cylindrical and coaxial. The gaseous molecules move axially parallel towards an adsorbent bed which is cylindrical too and coaxial to the diffusive surface. The BTEX, sampled in urban environments by the cartridge, are thermally desorbed. The Radiello campaign allowed to monitor the urban air quality with a high spatial resolution.

Polluting vehicles

Data was based on the yearly update of countings from PRA – Public Register of Vehicles and other organisations (ANCMA, CNR, etc).

Noise level

All measurements were run on the spot and each one lasted at least 30 min. For every spot, the measure was repeated in different days, according to the procedure described in the baseline section.

C5: Achievement of quantifiable targets:

A comparison among indicators values, according to the ex ante and ex post phases is provided below; values for the do-something scenario, being developed for single measures, are reported separately as a comparison between do-nothing and do-something scenarios.

Ex ante – Ex post phases

Emissions of Particulates, CO and C6H6 – table 4

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

Emissions Indicators								
MIRACLES number	METEOR number	Indicator (Units)	Value base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.2.a R5.2/Env.2.a R6.1/Env.2.a R6.2/Env.2.a R7.3/Env.1.a R8.1/Env.1.a R9.1/Env.1.a R12.1/Env.1.a	9	emissions of CO(kg/h and kg/day)	1)56.889 2)372.895	1)16497 2)115484	1)9498 2)66.490	1)9455 2)68189	1)11.216 2)88.080	1) peak hour 2) all mean workday Baseline, Frozen and Trend values are referred to Whole city Base year values and ex-post values are referred to Rail ring area
R5.1/Env.2.b R5.2/Env.2.b R6.1/Env.2.b R6.2/Env.2.b R7.3/Env.1.b R8.1/Env.1.b R9.1/Env.1.b R12.1/Env.1.b	10	emissions of particulates (kg/h and kg/day)	1)35,35 2)271	1)76,7 2)536,9	1)52,8 2)369	1)52,4 2)367	1) 21,2 2) 153	1) peak hour 2) all mean workday Baseline, Frozen and Trend values are referred to Whole city Base year value and ex-post values are referred to Rail ring area
R5.1/Env.2.c R5.2/Env.2.c R6.1/Env.2.c R6.2/Env.2.c R7.3/Env.1.c R8.1/Env.1.c R9.1/Env.1.c R12.1/Env.1.c		emissions of C6H6 (kg/h and kg/day)	1)96 2)697			1)48,5 2)349,5	1) 60 2) 433	Rail Ring Total emissions referring to: 1) peak hour 2) all mean workday Baseline, Frozen and Trend values are referred to Whole city Base year value and ex-post values are referred to Rail ring area

Table 4 – Emissions indicators

Concentrations of Particulates, CO and C6H6 – tables 5 and 6:

Concentration Indicators								
MIRACLES number	METEOR number	Indicator (Units)	Value base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.3.a R5.2/Env.3.a R6.1/Env.3.a R6.2/Env.3.a R7.3/Env.3.a R8.1/Env.2.a R9.1/Env.2.a R12.1/Env.2.a	5	concentrations of CO (millig/m ³)	1.77			No data available	1.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stations)
R5.1/Env.3.b R5.2/Env.3.b R6.1/Env.3.b R6.2/Env.3.b R7.3/Env.3.b R8.1/Env.2.b R9.1/Env.2.b R12.1/Env.2.b	6	concentrations of particulates (microg/m ³)	50.0				44.4	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (4 stations)
R5.1/Env.3.c R5.2/Env.3.c R6.1/Env.3.c R6.2/Env.3.c R7.3/Env.3.c R8.1/Env.2.c R9.1/Env.2.c R12.1/Env.2.c		concentrations of C6H6 (microg/m ³)	1)8.75 2)6.6				1)5.55 2)4.8	Measured value by monitoring network: mean of the yearly values of the stations inside the Lab area (3 stations) 2) Measured value by passive samplers

Table 5 – Concentrations indicators

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
 Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
 Evaluation Area: Environment

Project: MIRACLES
 City: Rome

	2001	2002	2003	2004	2005	2006
CO (mg/m ³)	1,77	1,663	1,556	1,449	1,342	1,235
Benzene(microg/m ³)	8,75	7,753	6,756	5,759	4,762	3,765
PM ₁₀ (microg/m ³)	50	49,2	47,203	46,208	45,209	44,212

Table 6 – Concentrations trend, do-nothing scenario

Polluting vehicles

Polluting Vehicles								
MIRACLES number	METEOR number	Indicator (Units)	Value base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.1.a R5.2/Env.1.a R6.1/Env.1.a R6.2/Env.1.a	-	polluting vehicles (no of polluting vehicles)	1) 868.720 2) 441.110 3) 64.796	a)465829 b)366923 c)121991 d)101564 e)2536	a)399728 b)356860 c)163015 d)158338 e)2536	a)397834 b)353689 c)163804 d)156311 e)2573	1) 550.319 2) 242.140 3) 42.435	Values are referred to whole city and to: 1)Not cat cars; 2)Not cat 2-wheels; 3)Not cat comm. a)Gasoline car<1,4t b)Gasoline car>1,4t c)Diesel car <1,4 t d)Diesel car >1,4 t e)Buses

Table 7 – Polluting vehicles indicators

Noise level

Noise level								
MIRACLES number	METEOR number	Indicator (Units)	Value base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Env.4.a	12	day/night level (dB(A))	L _{day} = 67	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 62 L _{night} = 60	<i>Frozen and Trend values</i> No variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS <i>Ex-post value</i> The area is closed from 9 p.m. to 3 a.m., and the day time is 6-22 , and night time is 22-66.
R6.1/Env.4.a	12	day/night level (dB(A))	L _{day} = 67	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 62 L _{night} = 60	<i>Frozen and Trend values</i> No variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS <i>Ex-post value</i> The area is closed from 9 p.m. to 3 a.m., and the day time is 6-22 , and night time is 22-66.
R12.1/Env.4.a	12	day/night level (dB(A))	L _{day} = 72 Law limit 65 dB(A)	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 65 L _{night} = 55	L _{day} = 68.5	<i>Frozen and Trend values</i> No variation due to the enforcement of acoustic recovery plan; results directly transferable to ITEMS <i>Ex-post value</i> During these years, there was also a renewal of the paving.

Table 8 – Noise level indicator

Do-something scenario

Most relevant targets in the MIRACLES scenario, under the environmental point of view, could be achieved by the

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
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possible application of the following measures: 5.1 set up of city centre clean zones, related to the application of ACS to the S. Lorenzo and Trastevere Areas and to the pedestrianization of the Tridente area. For the former areas a Miracles scenario was repeated simulating also the variation of impacts on the environment due to the introduction of electric buses (i.e., measure 7.3 – introduction of new lines). Eventually, impacts, in term of vehicles emissions, due to the introduction of these new buses (30 trolley buses, 36 electric buses and 200 EURO III buses) in Rome environment were assessed (measure 12.1 Clean vehicles buses).

The Access Control System - ACS implementation and the introduction of electric buses at S. Lorenzo and Trastevere Areas. Comparisons between “with and without” the ACS measure application are synthesized below, respectively in Table 9 for S. Lorenzo and in Table 10 for Trastevere:

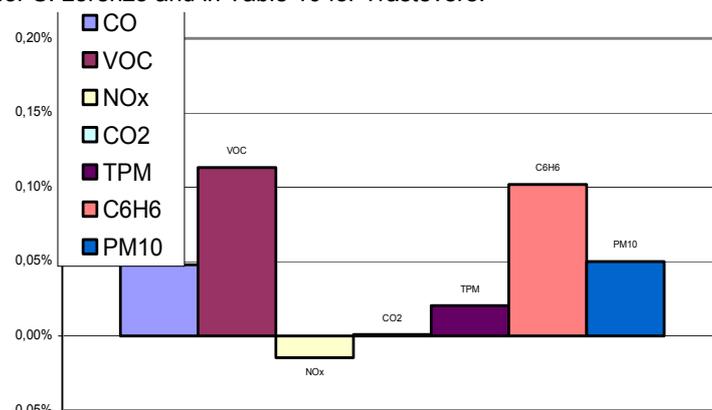


Table 9 - Percentage variation of environmental pollutant (CO, VOC, NOx, CO2, PM) for the whole city (application of ACS to S. Lorenzo)

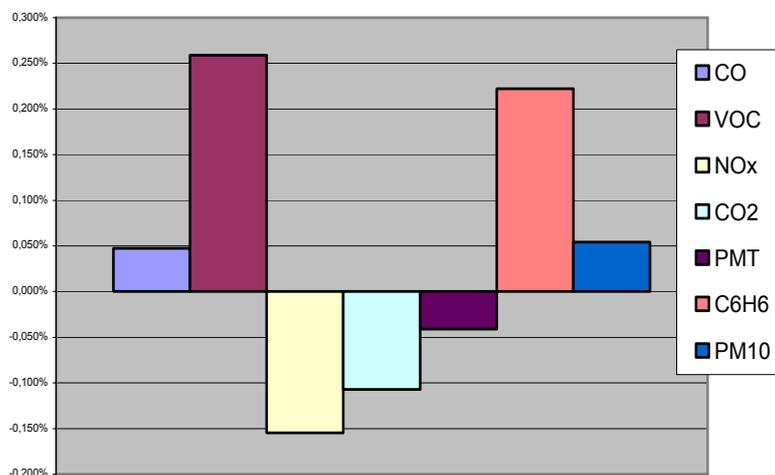


Table 10 - Percentage variation of environmental pollutant (CO, VOC, NOx, CO2, PM) for the whole city (application of ACS to Trastevere)

The introduction of traffic restriction schemes in Trastevere and S. Lorenzo districts in combination with new bus services, implied a new modal split and flow distribution. In this case, three different scenarios were taken into account for the assessment:

- “Without” traffic restrictions in S. Lorenzo and Trastevere districts
- “With” traffic restriction and new electric buses supplying Trastevere and S. Lorenzo districts.
- “With” traffic restriction and conventional buses used to serve the two zones.

The expected percentage variation in pollutants (CO, VOC, NOX, CO2, PM) is shown in Table 11 for S. Lorenzo district and in Table 12 for Trastevere district. The “without access restrictions” scenarios are compared with second scenario (with traffic restriction and new electric buses) and with a third scenario (with traffic restriction and

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

conventional buses).

As electric buses do not emit any pollutant, a decrease of 100% is reported in the second column for second scenario. In third column, a decrease of CO and VOC and an increase of NOX, CO2 and particulate were estimated.

Pollutant	With electric buses	With conventional buses
CO	-100%	-49%
VOC	-100%	38%
NOX	-100%	442%
CO2	-100%	305%
PM	-100%	86%

Table 11 – Percentage variation of pollutant emissions in S. Lorenzo

Pollutant	With electric buses	With conventional buses
CO	-100%	-70%
VOC	-100%	-19%
NOX	-100%	220%
CO2	-100%	139%
PM	-100%	10%

Table 12 – Percentage variation of pollutant emissions in Trastevere

The Tridente pedestrianization

Two scenarios were taken into account for the simulation: “without” and “with” the measure. Both simulation scenarios were referred to the morning peak, when the central LTZ is operative.

In the first scenario (“without” pedestrian area) only vehicles with permit to main LTZ were admitted. In the second one (“with” pedestrian area) streets inside the pedestrian area could not be travelled

Table 13 shows the differences of emissions (CO, VOC, NOx, CO2, TPM, C6H6, PM10), expressed in Kg, in a logarithmic scale. The percentage variation for all the emission categories was 0,0042%.

Due to the increase of vehicle-km, an increase of emissions could be observed, even if, in absolute term, the overall effect of measured factors had to be considered negligible.

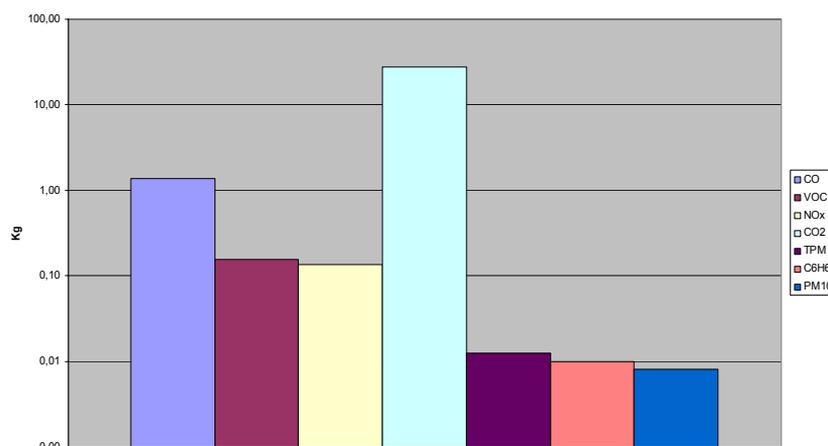


Table 13 - Percentage variation of environmental pollutant (CO, VOC, NOx, CO2, PM) for the whole city (Trastevere pedestrianization)

Introduction of clean buses

The aim of this work was the assessment of impacts, in term of vehicles emissions, due to the introduction of these new buses (30 trolley buses, 36 electric buses and 200 EURO III buses) in Rome environment.

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level
Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)
Evaluation Area: Environment

Project: MIRACLES
City: Rome

For the "with measure" scenario the substitution of 266 EURO 0 buses with 30 trolley buses, 36 electric buses and 200 EURO III buses was considered. Given the percentage decrease of EURO 0 buses and the increment of EURO III buses after the introduction of new vehicles, the corresponding decrease of pollutant, reported in Table 14, was expected.

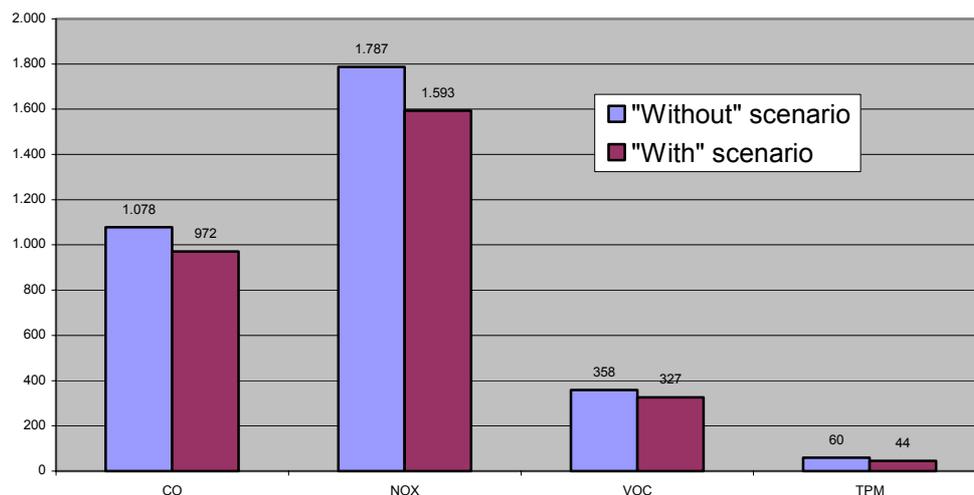


Table 14 - Estimated pollutant emissions (in tons) for simulated scenarios

C6: Report on results:

The study if all the indicators allowed to assess positive results both in the ex ante forecast and in the ex post phase. Given the peculiarity of each set of indicators, it is worth to report the different results related to each one of them.

Emissions of Particulates, CO and C6H6

As already stressed when describing the context of application (see C3), the situation of the city under the environmental point of view was not that brilliant, so any forecast and any scenario became particularly interesting, mainly for what concerned emissions and concentrations.

For what concerned the former, the do-nothing study (run by ITEMS) esteemed very strong reductions between baseline and frozen/trend scenarios, for PM10 (round 31%) and for CO (round 42%), with a very small decrease for CO2 (1%), the latter not among the Rome MIRACLES indicators. In detail, both CO and particulate emissions decreased in baseline and trend scenarios as resulted from data on average workday: in baseline scenario there were 115.484 kg/day (CO) and 536,6 kg/day (PM10), in the trend one respectively 68.189 kg/day and 367 kg/day and eventually in the frozen one 66.490 kg/day (CO) and 369 kg/day (PM10). For what concerned Benzene, since ITEMS didn't provide data on this pollutant, emissions calculated by a linear progression (see C4), allowed to esteem a trend scenario in which C6H6 decreased rapidly.

These strong reductions, without any MIRACLES intervention/measure, could be obtained only assuming a big renewal of circulating vehicles fleet.

Indeed, if the MIRACLES scenario results are observed (see dedicated figures in C5) and reminding that the scenario was referred only to the application of ACS and to the renewal of a part of the PT fleet and that simulations referred to the whole city of Rome, no significant changes were remarkable. To be noted that an increase of CO and VOC was due to the contribution of moped use increase, while the decrease of NOx, CO2 and PM was due to the contribution of car use decrease, assuming that drivers who could not use anymore their cars, tended to switch to two-wheels. On the contrary, the forecast to substitute just more that 10% of the PT fleet with clean vehicles implied a reduction of all the pollutant factors.

But most positive results came from the analysis of the ex post results. Ex-post values showed a strong reduction in terms of emissions. CO emissions values dropped strongly, about 76%, both in peak hours and as all mean workday. This is due both to the renewal of circulating private car fleet and in general to the introduction of the whole MIRACLES measures package, in which ACS and the restriction of using of most polluting cars seemed to be the main reasons of improvement. For what concerned particulates and C6H6 emissions values,

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level

Project: MIRACLES

Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Environment

the reduction is about of 38%. The reasons were the same reported for CO emissions. Such results went beyond expectations concerning transport-related emissions, whose reductions were assessed by 13% inside the LTZ and by 5% in the other parts of the Laboratory area (see point C.1).

Concentrations of Particulates, CO and C6H6

For what concerns the ex ante phase, because of the difficulty of properly simulating trends of concentrations for a complex built environment as Rome (not even ITEMS allowed to simulate such concentrations trends), the comparison between baselines values and the do-nothing trend, assessed according to variations surveyed in years 2002 and 2003 and the related development according to a linear variation, led to hypothesize a reduction of the concentrations of the three pollutants, at city level, probably due to the turn over of old polluting vehicles to new low emissions ones.

A more interesting comparison was hence provided by relating baseline values to the ex post surveyed ones; in this case there was an overall reduction of all the pollutant parameters and the percentage reductions of CO and C6H6 concentrations (respectively:- 21% and – 37%) were stronger than the particulates one (- 11%). This was probably due to the improvement gasoline fuelled new cars. Indeed particulates emission rate of gasoline cars is higher than others.

Polluting vehicles

The need to consider such indicator (out from the METEOR core indicators list) is evident when ex-ante values are compared to what achieved in the ex post. Indeed, polluting cars affect very negatively the urban environment and the variation of the amount of them circulating in the city can help explaining the variation of pollutant factors. In the ex ante case, for what concerned baseline, frozen and trend scenarios, variations were detected only for some classes of vehicles; the most relevant one was due to a strong decrease of gasoline cars < 1,4 t between the ITEMS Baseline and Frozen scenarios; on the contrary, very small variations were reported between frozen and trend scenarios. It means that there is a trend linked to technical and economics factors. Values achieved in the ex post phase, showed for, what concerns circulating vehicles, a reduction of not catalysed vehicles. Private cars and mopeds dropped more strongly than commercial vehicles.

This reduction was due to a synergy between a natural renewal of circulating fleet and the measures aimed at restricting the circulation of polluting vehicles, mainly as expected from WP5, WP12 interventions.

Noise level

It is not correct to make comparisons, in terms of forecasting values, in an urban environment in which noise sources are so manifold and not only linked to mobility reasons. Also modelling results are not fully reliable when the areas they deal with are as big as the Laboratory area and land use is so different.

Hence, starting from the baseline data coming from surveys “on-the-spot”, it was assumed that the progressive enforcement of law nr. 447/95 (Acoustic Recovery Plan), allowed to forecast for the year 2006 a day level of 65 dB(A) and a 55 dB(A) night level, at city level.

Neither variations over these limits could be acceptable, nor values strongly below can be realistically expected, given no real changes in the typology of the noise sources. On this hypothesis, and for this indicator only, do-nothing and do-something data should coincide, since they had to meet law requirements.

From the comparison between baseline and do-nothing data, expected values for measures 5.1 and 6.1, i.e. -2 dB(A) could be feasible to achieve, while higher decreases (- 7/10 dB(A)) that measures 5.2 and 12.1 would require, won't be possible unless massive interventions on the noise sources. It is also important to remember that dB(A) units are based on a logarithmic scale, then just 1 dB(A) less means a good improvement. Ex post values, hence, are very positive, since an overall reduction in terms of noise level was surveyed, and this was due mainly to the implementation of LTZ in the laboratory area. Also values still over the law requirements, as for the measure 12.1, can be positively assessed, since the MIRACLES interventions succeeded in reducing 3.5 dB(A) with no interventions on the noise sources.

Lessons Learned – what do other cities, other actors and the EC have to consider?

C7: Lessons learned:

If the positive outcomes between before and after MIRACLES applications cannot be denied, since all indicators showed improvements due to the application of the measures, it is worth to stress some apparently side-aspects.

The most important can be synthesized as follows: “the more complex is the urban environment, the more synergic must be the approach to solve environmental problems due to mobility”. Indeed, in this domain, it is very difficult to detect environmental benefits coming from just one single measure, even if at a large scale. On the contrary, the application of a bunch of measures (as in the case of MIRACLES) is easily detectable because it makes soon evident environmental benefits at urban scale.

CITY-LEVEL RESULTS

Indicators title: Emissions, Concentrations, Noise level

Project: MIRACLES

Indicator number: 5, 6, 9, 10, 12 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Environment

Moreover, in such a complex system, benefits cannot be linked just to MIRACLES; indeed, other emergency actions were and are currently operative, in order to improve air quality; among these, the ultimate "alternate plates" one, set by the Rome Municipality and in force since the end of January 2004, on Wednesdays, from 15,00 to 19,00; it lasted (and currently lasts) ten weeks and it allowed the circulation of private cars with alternatively odd or even last number of their plates, with exception of mopeds and methane or LPG fuelled vehicles. Such measure was integrated with the total restriction to cars on Sundays, from 10,00 to 17,00, a national measure that involves not only Rome but many other metropolitan areas.

Taking into consideration such extra factors, the synergy between "MIRACLES" and "extra MIRACLES" measures, besides external factors, as for instance the weather condition, could positively affect the environmental situation but it is very difficult to assess it by a theoretical study as the creation of a do-nothing or a do-something scenario. Such statement can be confirmed, for example, by the simple comparison of pollution data related to the periods January/June 2002, to same data of the period January/June 2003; the latter, starting period of implementation of some measures, allowed to say that the measures implementation in synergy with other factors, as the weather conditions, contributed to slight decrease of some pollutant elements as surveyed.

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26. City-level Results - Society

CITY-LEVEL RESULTS	
Indicators group title: Awareness and accessibility levels Indicator number: 13 Awareness, 14 Acceptance (METEOR Core Indicator #) Evaluation Area: Society	Project: MIRACLES City: Rome
<i>The Indicator – what is it about?</i>	
C1: Local objectives and quantifiable targets:	
<p>Awareness, acceptance, satisfaction levels as well as use motivation and expectations towards involved bodies formed an indicators set, aimed at assessing the degree to which the sensibility towards sustainable mobility was increased by the group of measures implemented within the Miracles Demonstration project.</p> <p>In particular, this indicators set concerned the evaluation on how such feelings were transformed thanks to new interventions on set-up of city clean zones and of green corridors, on time based entrance and adoption of policies and environmentally linked parking charges, on the introduction of new PT lines and on the improved integration of transit, on new services, on the mobility management and on improved multimodal traveller service, on clean vehicles buses.</p> <p>Such a group of indicators was aimed at expecting to increase public awareness and support for sustainable transport by 20%. For the sake of brevity, this group of indicators will be further mentioned as “Awareness indicators”.</p> <p>Within the Evaluation Category “Society”, besides indicators that depicted people perception, there were other indicators targeted to assess “material” changes as the improvement of travel conditions for disabled (indicator: “Provision for disabled people”) and for tourists (“Provision for tourists”), and the media support (indicators: “Availability of information via media”, “Number of e-tickets sold via SMS” and “Visitors on web sites”); both could be seen as quantitative supplies, in terms of accessibility to the service, to be added to the assessment of the overall change of sensibility occurred to Romans. This group of indicators will be defined as “Accessibility indicators”, meaning by accessibility the opportunity for all to access services and places.</p> <p>Given the distinctiveness of indicators related to acceptance and awareness issues, no specific do-nothing scenarios have been developed; nonetheless, an in-depth comparison between before and post MIRACLES Measures was run, as part of a dedicated methodology (see sections C3 and C4).</p>	
C2: Indicator description:	
<p><u>Awareness indicators</u></p> <p>The five indicators related to the change of sensibility among the Romans were:</p> <ol style="list-style-type: none"> 1. awareness 2. acceptance level 3. use motivation 4. satisfaction level 5. expectations towards involved bodies; <p>In particular:</p> <p><i>Awareness</i>: - The indicator defined the percentage of change of awareness on a given measure, as perceived by a group of users</p> <p><i>Acceptance</i>: - The indicator defined the score (Lickert scale: 1-5) of change of acceptance on a given measure, as perceived by a group of users. It defined how the satisfaction score takes part in the different clusters of the local culture</p> <p><i>Use motivation</i>: - The indicator defined the percentage of change of use motivation as perceived by a group of users. It's composed by way of moving and frequency of using various types of transport</p> <p><i>Satisfaction</i>: The indicator defined the score (Lickert scale: 1-5) of change of satisfaction on a given measure, as perceived by a group of users.</p> <p><i>Expectations towards involved bodies</i>: -The indicator defined the percentage of change of expectations towards Public Administration, as perceived by a group of users. The indicator explored expectation towards: customer satisfaction survey, services, productive activities, art. It can be useful related to the percentage of reliability of the city (schools, health care and public order)</p> <p>Moreover, the indicators were all considered possible elements of the Rome “Local Culture”. Thus, the percentage of participation to each of the 5 clusters that define the Local Culture for what concerns traffic and viability, was verified</p>	
<p><u>Accessibility indicators</u></p> <p>For what concerns the other indicators on accessibility:</p> <p><i>Provision for disabled people</i>: It defined the number of tools and devices on board and/or at stops dedicated to physically challenged people</p>	

CITY-LEVEL RESULTS	
Indicators group title: Awareness and accessibility levels Indicator number: 13 Awareness, 14 Acceptance (METEOR Core Indicator #) Evaluation Area: Society	Project: MIRACLES City: Rome
<i>Provision for tourists:</i> It defined the number of tools and devices dedicated to tourists <i>Availability of information via media:</i> It defined the possibility to contact citizens via web, ordinary mail and by phones <i>Visitors on web sites :</i> It defined the number of people visiting PT company, ATAC, and institutional bodies web sites <i>Number of e-ticket sold via SMS:</i> It defined the amount of e-ticketing via cell phones	
C3: Context and relevance:	
<p>Since in Italy there was neither long-time tradition about public involvement on mobility matters nor pressure groups strong enough to start this process, the purpose of the whole set of Society indicators, as listed in section C1, was to have a holistic approach to communication and behavioural problems of the users. In particular, the set of Awareness indicators was framed within the domain of Local Culture in social organizations and social behaviour. Such field was based on a methodology for evaluation and analysis of Local Cultures in social Organisations and in Communities, in which theoretical models of relationship between Local Cultures and Customer Satisfaction, attitudes, opinion, preference measurement, in social Groups and in social Organisations were developed. It is also related to studies on Cultural Segmentation of social Organisations and Communities, to evaluate different attitudes and effects of specific policies in social changes.</p> <p>Also for what concerns the so-called accessibility indicators, there was no usual habit in collecting data about them, neither for number of installed equipments nor for users accessing a given service/information.</p>	
<i>The Evaluation –what are the results?</i>	
C4: Method of measurement:	
<p><u>Awareness indicators</u></p> <p><i>The process</i></p> <p>For what concerned the five indicators related to the change of sensibility, the study process was carried out through the following steps:</p> <p>A – seven MIRACLES initiatives/measures were studied:</p> <ol style="list-style-type: none"> 1. pay-parking 2. access restriction 3. non-polluting buses 4. collective taxis 5. flexible parking 6. telematics at bus stops 7. car-sharing <p>B – the survey to measure the level of perception of the measures was carried out twice: in 2002 and 2005</p> <p>C – the surveys (a.k.a. “measurements”) concerned awareness and satisfaction levels for each considered measure</p> <p>D – there were two criteria for the study process (a.k.a. “verification” process):</p> <ol style="list-style-type: none"> 1. comparison of awareness and satisfaction levels based on the initial and final surveys data 2. division into segments of the measurements of awareness and satisfaction levels, within the different elements of Local Culture, towards traffic, and surveyed by means of a sample of Roman inhabitants <p>E – in addition, two general issues were taken into consideration: the reason for using means of transport and expectations towards the city administrations.</p> <p><i>The measurements</i></p> <p>The measurements were run according to the following steps.</p> <p>A questionnaire for the telephonic interviews (accordingly to studies already started in 1998):</p> <ul style="list-style-type: none"> - an “ISO” questionnaire was hence prepared (ISO was the acronym of Organisational Development Indicators, according to a specific methodology developed by Renzo Carli and his staff), composed of 175 items; - a team of psychologists submitted the “iso” questionnaire to 420 people; - analysis of the data obtained through the questionnaire and work-up of a five-cluster model; - preparation of a “reduced” questionnaire (32 items), enabling the classification of new subjects in the five-cluster model. <p>The 2002 phase:</p> <ul style="list-style-type: none"> - submission of the “reduced” questionnaire to a representative sample (1,400 people) of the Roman population (1,823,190 inhabitants) by telephone interviews; 	

CITY-LEVEL RESULTS

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- positioning of the Roman population in the five-cluster model.

The January-March 2004 phase:

- setting up of 10 focus group (10 groups of 8-10 subjects each; 90 minutes each) in order to survey the cultural models of Roman citizens on traffic, as a "prequel" of a new positioning by the telephone interviews foreseen for 2005.

The March 2005 phase:

- submission of the same questionnaire (**) used in 2002 to a representative sample (1,410 people*) of the Roman population (1,823,190 inhabitants) by phone interviews;

- re-positioning of the Roman population in the five-cluster model.

(*)resident in Rome; zone of residence, gender, age (over 14 years old); work.

(**) some items aimed at verifying awareness/satisfaction of the new services offered by the Municipality of Rome and/or ATAC were introduced into the questionnaire submitted in March 2005.

The clusters

The clusters, to which Tables 3-5 refer, can be described, starting from the 2002 survey; they identified the cultural models used by roman citizens, for regulating and planning their behaviour in the urban traffic, according to 5 groups (or clusters) of requirements (or attitudes) and their share: control (or check), confidence, mistrust (or lack of confidence), efficiency, anarchy. In synthesis, these feelings can be described as follows:

Confidence towards the communities and the local administration is a very important feeling among the Romans, but such positive attitude turns into negative when instead of the "city", the "citizens" are considered. They are considered guilty of not feeling responsible, in terms of city care, and of not paid enough attention to negative aspects as crime or to the poor cultural panorama of the city. The contrast is more evident when dealing with public/private transportations: even if the use of public modes is not adequately promoted by the Municipality, traffic situation is unaffordable because Romans cannot stop driving.

By *Control*, it is meant the need to control the traffic situation, day by day worse because of people misbehaviors; this leads to an overall requirement for more enforcement and higher fines for offenders, and to accept LTZs, payment for parkings and pedestrianizations. Some concerns are expressed on the negative effects of traffic pollution on the neighbourhoods.

Anarchy is the opposite feeling expressed by the Romans; such an attitude seems to originate from the motto " the worst, the better!". Dissatisfaction and impatience are the keywords; there is no need to control traffic or to issue fines: any extra enforcement action will make the situation worse, given the total not livability of the city. Of course, interviewees do not trust the Municipality, but personal initiatives are highly appreciated.

Efficiency of transportation services is also considered as essential by the Romans; in particular, poor performance are attributed to taxi and bus services, and according to what expressed apropos *Check*, LTZs, pricing and restrictions in general are perceived as expressions of efficiency.

Mistrust is a feeling in which interviewees do not have confidence neither with citizens nor with administrators; also in this case, a total deregulation for what concerns the traffic governance is required as well as the free use of private cars, but not of two-wheels vehicles; indeed mopeds and motorcycles are seen as a way of show off.

Accessibility indicators

For what concerns the other indicators on accessibility, data were provided by ATAC databases.

C5: Achievement of quantifiable targets:

Awareness indicators

The assessment of the MIRACLES measures

In table 1, percentages about awareness of the most relevant MIRACLES measures are reported

MEASURES	2002 values (ex ante)	2005 values (ex post)	difference	Difference relevance
Flexible parking	91%	95%	4%	n.r.
Access restriction	90%	89%	1%	n.r.
Clean buses	53%	76%	23%	<.01
Collective taxis		49%		
Parking policies	32%	46%	14%	<.05
Telematics		41%		
Car-sharing		14%		

Table 1 – Variation on awareness of the most relevant MIRACLES measures (sample of 1410 Roman users)

CITY-LEVEL RESULTS

Indicators group title: Awareness and accessibility levels

Project: MIRACLES

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In Table 2, scores (1 – 5 Lickert scale) about satisfaction on the most relevant MIRACLES measures are reported.

MEASURES	2002 values (ex ante)	2005 values (ex post)	difference	Difference relevance
Flexible parking	3.30	2.52	.78	<.01
Access restriction	3.88	3.27	.61	<.01
Clean buses	3.60	3.96	.36	<.05
Collective taxis	-	3.13	-	-
Parking policies	3.90	3.57	.33	n.s.
Telematics	-	3.72	-	-
Car-sharing	-	3.06	-	-

Table 2 – Variation on satisfaction on the most relevant MIRACLES measures (sample of 1410 Roman users)

In Table 3, percentages about how awareness are presented according to the different clusters.

	population	Cluster 1 control	Cluster 2 confidence	Cluster 3 anarchy	Cluster 4 efficiency	Cluster 5 mistrust
Telematics (meas.11.1)	2002: -----	-----	-----	-----	-----	-----
	2005: 41%	49%	38%	40%	52%	40%
Clean buses	2002: 53%	65%	42%	46%	60%	51%
	2005: 76%	85%	73%	73%	80%	74%
Flexible parking rate	2002: 91%	93%	89%	89%	90%	92%
	2005: 95%	96%	95%	94%	92%	95%
Parking policies (P&R)	2002: 32%	40%	30%	31%	22%	42%
	2005: 46%	61%	41%	42%	33%	57%
Car-sharing	2002: -----	-----	-----	-----	-----	-----
	2005: 14%	24%	12%	9%	11%	17%
Collective taxis	2002: -----	-----	-----	-----	-----	-----
	2005: 49%	56%	48%	43%	54%	51%
Access restriction	2002: 90%	91%	88%	88%	90%	93%

Table 3 – Variation on awareness of the most relevant MIRACLES measures, per clusters (sample of 1410 Roman users)

In Table 4, scores (1 – 5 Lickert scale) about how satisfaction are presented according to the different clusters

CITY-LEVEL RESULTS

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	popolazione	cluster 1 control	cluster 2 confidence	cluster 3 anarchy	cluster 4 efficiency	cluster 5 mistrust
Telematics (meas. 11.1)	2002: -----	-----	-----	-----	-----	-----
	2005: 3.72	3.87	4.00	3.29	3.47	3.01
Clean buses	2002: 3.60	3.98	4.10	2.88	3.12	3.01
	2005: 3.96	4.13	4.18	3.46	3.89	3.53
Flexible parking rate	2002: 3.30	4.13	3.31	2.68	3.32	3.01
	2005: 2.52	3.33	2.57	1.77	2.61	2.08
Parking policies (P&R)	2002: 3.90	4.21	3.97	2.88	3.99	3.66
	2005: 3.57	3.80	3.65	3.16	3.63	3.41
Car-sharing	2002: -----	-----	-----	-----	-----	-----
	2005: 3.06	3.15	2.90	2.81	3.57	3.56
Collective taxis	2002: -----	-----	-----	-----	-----	-----
	2005: 3.13	3.19	3.27	2.78	3.00	3.06
Access restriction	2002: 3.88	4.74	4.18	2.94	4.45	2.12
	2005: 3.27	3.84	3.37	2.73	3.42	2.56

Table 4 – Variation on satisfaction on the most relevant MIRACLES measures, per clusters (sample of 1410 Roman users)

In table 5 the variation of the relevance of the clusters according to both 2002 and 2005 data is summarized:

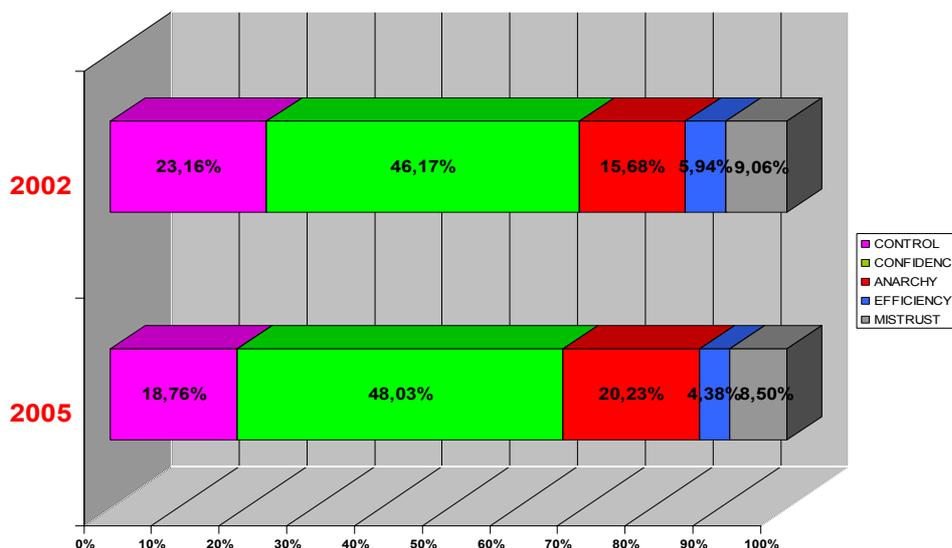


Table 5 – Variation of clusters between 2002 - 2005

The citizens expectations

In addition, Tables 6 and 7 describe both citizens' expectations towards the city administrations, with special attention to investments on extra issues as cultural heritage, services, etc. along with the citizens feeling of reliability in the administration. Table 8 reports the variation of mobility motivations, as from the 2002 – 2005 surveys.

All these data and information contributed to profile the Local Culture on traffic in 2005 and its differences with the

CITY-LEVEL RESULTS

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2002 situation, as synthesized in Table 9.

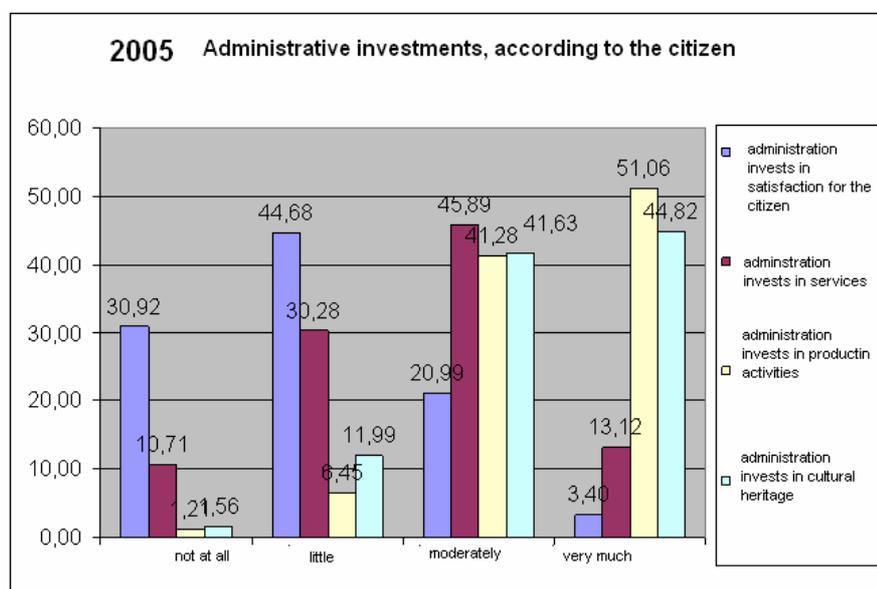
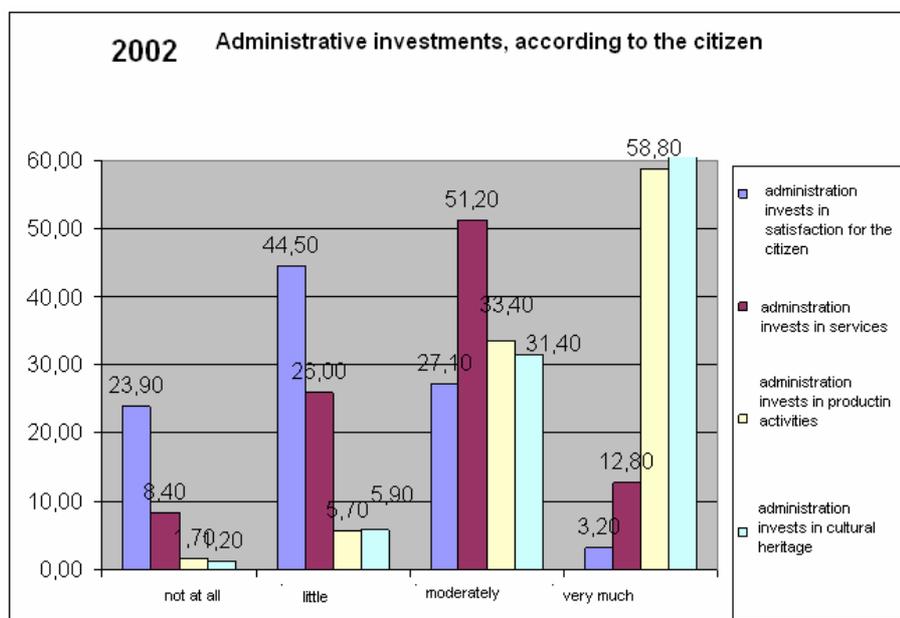


Table 6 – Variation of investment expectations between 2002 - 2005

In 2005, investment expectations for satisfying clients and services remained high. Investments in cultural heritage and production activities appeared more recognised by the citizens (see table 6)

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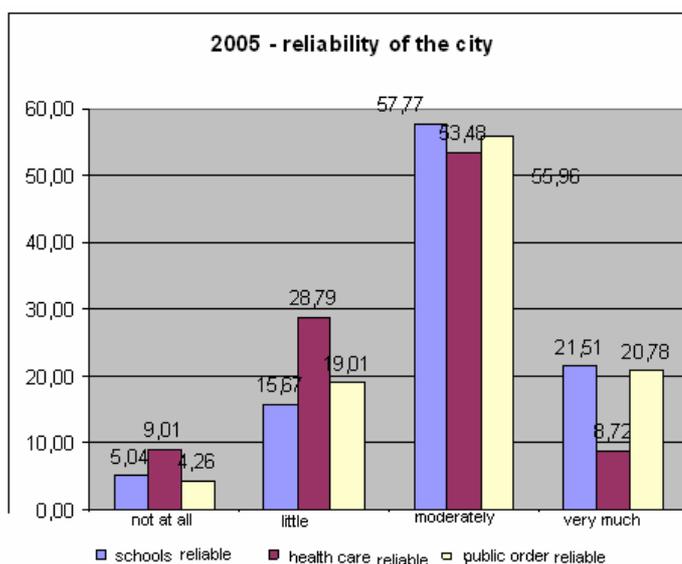
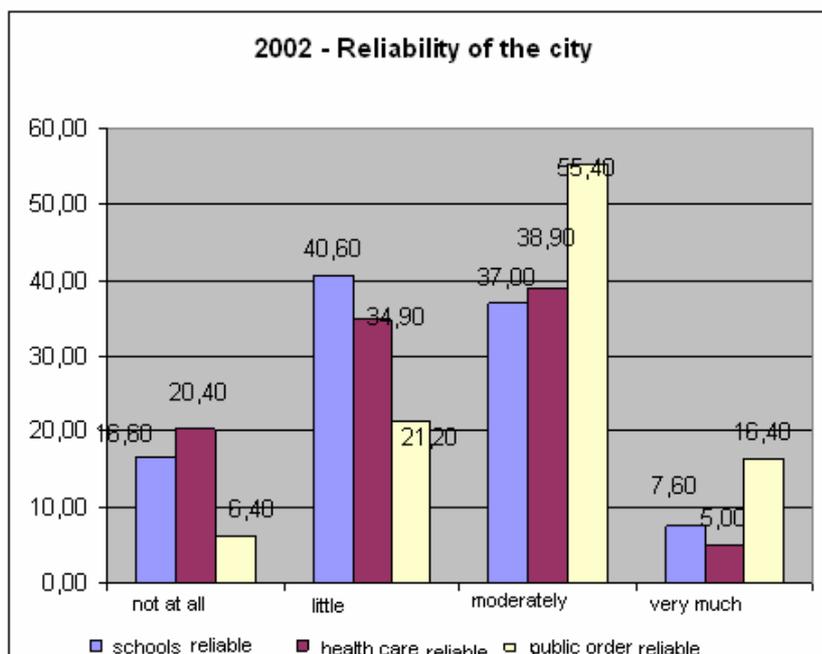


Table 7 – Variation of reliability between 2002 - 2005

With regard to the citizens' feeling of reliability in their Administration, the highest values (moderately and very much) increased in the 2005 survey. Citizens perceived some improvements in the management of crucial aspects, such as schools, health care and public order. Data seemed to stress a shift towards positive expectations about the city administration (see table 7).

CITY-LEVEL RESULTS

Indicators group title: Awareness and accessibility levels

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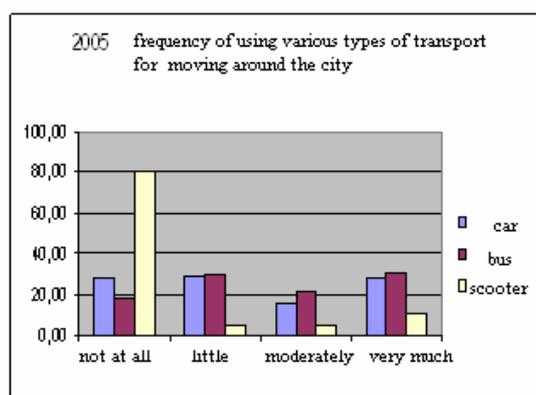
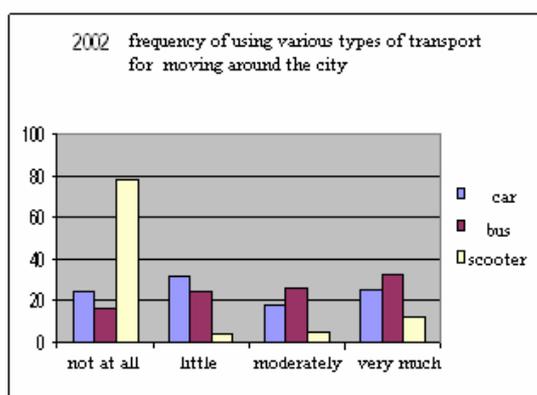
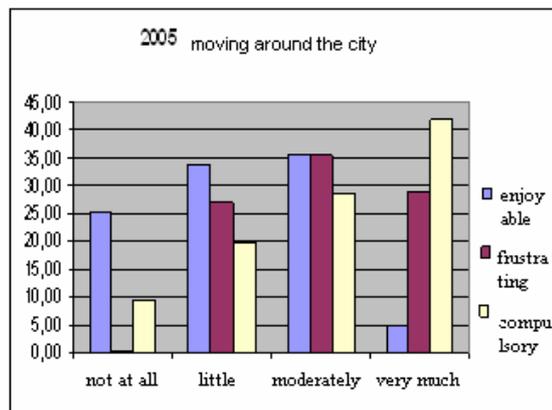
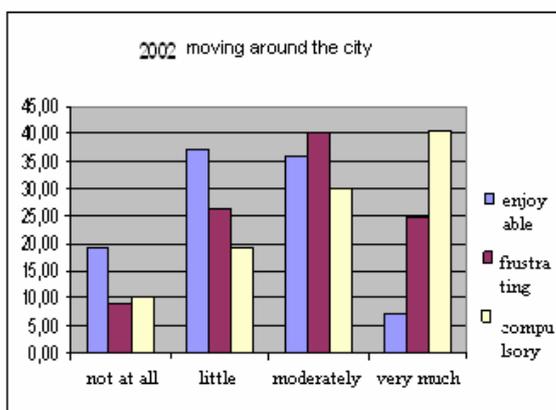


Table 8 – Variation of mobility motivations between 2002 – 2005

Feelings of constraint and frustration typified the mobility of Roman citizens and their mobility motivations, showing an increase of these two aspects in 2005.

With regard to the use of private and public transport and motorbikes, there were no marked differences between the two surveys (see table 8)

The changes in the cultural patterns

Facts concerning the variations of the Cultural Repertoires – RC, according to the two surveys are summarized as follows:

In 2002:

- R.C. 2 confidence: 46.17%
- R.C. 5 mistrust: 9.06%
- R.C. 1 control: 23.16%
- R.C. 3 anarchy: 15.68%
- R.C. 4 efficiency: 5.94%

In 2005:

- R.C. 2 confidence: 48.03%
- R.C. 5 mistrust: 8.50%
- R.C. 1 control: 18.76%
- R.C. 3 anarchy: 20.23%
- R.C. 4 efficiency: 4.38%

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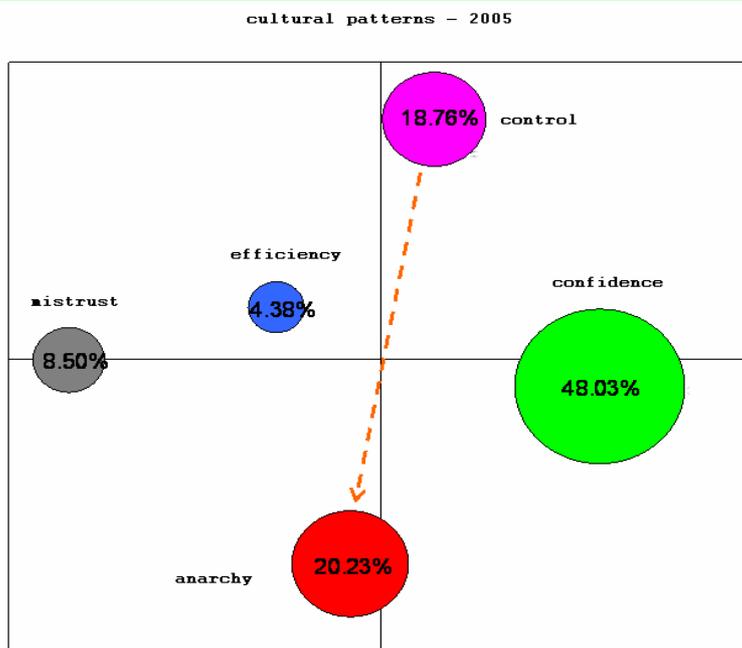


Table 9 – Variation of the culture of traffic between 2002 - 2005

According to these data, significant changes occurred in the Culture of traffic between the years 2002 and 2005:

1. the Control Cultural Pattern - CP dropped considerably (from 23.16% to 18.76%, a difference of 4.4%)
2. the Anarchy CP increased notably (from 15.58% to 20.23%, a difference of 4.65%)

The clusters that provided such result were composed as follows:

Cluster 1 - control:

Mostly adult males, with medium to high educational degrees.

Recurring jobs: clerks, teachers, technicians, managers, officials, directors, free-lancers, students.

They used to move in off-peak hours and mainly in central areas, between the city centre and surrounding areas.

Means of transport used: car and motorbike - *little or none*; transit - *rather frequently/a lot*.

Cluster 2: confidence

Adults and elderly, and mainly females, with low educational degrees. No young people

Recurring jobs: housewives, retired, handcrafts men and tradesmen.

They used to move inside the central area as well as in the surroundings, not in rush-hour times.

Means of transport used: car and motorbike - *little or not at all*; transit - *moderately/very much*.

Cluster 3 - Anarchy:

Mostly adult males, with low educational degrees.

Recurring jobs: workers, retired, civil servants, students.

They used to move in the outskirts and in rush-hours.

Means of transport used: car and motorbike - *quite frequently/a lot*; transit - *little or not at all*

Cluster 4 – Efficiency:

Both adults and young people, mostly females, with either high (graduation) or low (elementary or middle school) educational degrees.

Recurring jobs: unemployed or temporarily workers; managers and executives; housewives; practitioners.

They used to move inside the central area as well as in the surroundings, not in rush-hours.

Means of transport used: car and motorbike - *little or not at all*; transit - *moderately/very much*.

Cluster 5 – Mistrust:

Both adults and young people, mostly females, with high educational degrees.

Recurring jobs: practitioners, retired, employees, teachers, handcrafts men and tradesmen.

They used to move from the central area to the surroundings and vice versa, in peak hours.

Means of transport used: car and motorbike - *very much moderately*; transit – *very little or not at all*

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Glossary for the awareness indicators

local culture - All the collusive processes typical of a social system. Their function is the organization of the social relationships and the ways-of-living.

collusive processes (or cultural processes) -Emotional symbolization of a specific context, by people sharing that context.

way-of-living - It is, at the same time, a collusive and organizational event, concerning social dynamics.

clusters (cultural repertoires or Cultural Patterns) - The different ways in which the collusive processes typical of local cultures are expressed by the analyzed population.

cultural space - In statistics is the "factorial space"; according to our model it's the space where the cultural repertoires organize themselves.

emotional analyses of text – AET Instrument and methodology to outline collusive processes. It is based on the analyses of texts produced by focus groups or interviews, books, articles. It arranges data into cultural repertoires and cultural space. This methodology deals with emotionally building of social contexts. .

dense words - word with a "strong" emotional meaning. They are used to outline cultural repertory in groups.

Accessibility indicators

The assessment of the MIRACLES measures

Table 10 shows the comparison between ex ante/ex post values; in particular, no evolution could be assessed for what concerned the frozen/trend scenarios given the status of trial/one-off of the measures linked to the indicators; such trend was still not appreciable to the Miracles scenario extent.

Society indicators - accessibility								
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value	Value	Value	Ex-post Value	Notes
				ITEMS Baseline	ITEMS Frozen	ITEMS Trend		
R7.2/Soc.1.a		Provision for disabled people (no. per type)	995 on board (buses) 88 on board (trams)	No variations for frozen and trend scenarios			1664 on board (buses) 100 on board (trams) 100 buses with Braille signs	On 2001 ATAC distributed 100,000 CD-Rom with PT info for disabled people
R7.2/Soc.4.a		Availability of information via internet (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles since june 2002 Do something scenario: Yes
R7.2/Soc.4.b		Availability of information via phone (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles since june 2002 Do something scenario: Yes
R7.2/Soc.4.c		Availability of information via mail (Y/N)	Yes				Yes, 30% increase	Existing before the beginning of Miracles Since june 2002 Do something scenario: Yes
R7.2/Soc.1.b R10.1/Soc.1.b R11.1.3/Soc1.c		Visitors on web site for information (.)	48000**				200.000*** 10000 queries/month	** Number of visitors on ATAC website in January 2002 ***year 2005
R11.1/Soc.5.a		N. of e-ticket sold through SMS service (telepay)	3700* Esteemed average: 41 tickets/day				300 tickets/day	* trial lasted 3 months
R11.1.3/Soc1.b		Provision for tourist (no. per type)	none				A multilingual website 5 kiosks	

Table 10 – comparison between ex ante/ex post values for accessibility indicators

C6: Report on results:

Awareness indicators

Pay-parking, access restriction and, to a lesser extent, non-polluting public transport were the initiatives most known to Romans.

Looking at 2005, collective taxis, flexible parking, telematics and car-sharing were not well known, particularly the latter, which not only suffered from its English term, but also the emotional opposition between the car meant as a

CITY-LEVEL RESULTS	
Indicators group title: Awareness and accessibility levels Indicator number: 13 Awareness, 14 Acceptance (METEOR Core Indicator #) Evaluation Area: Society	Project: MIRACLES City: Rome
<p>place of intimacy and solitude and its being shared with other people.</p> <p>Cluster 1 (control) always was - in awareness – higher than average values, while cluster 3 (anarchy) had values that were consistently below the average. These two clusters changed in the comparison of the Local Cultures 2002-2005.</p> <p>There was still a major awareness of initiatives which led to limitations and costs for citizens: pay-for-parking and access restrictions.</p> <p>Satisfaction with non-polluting public transport increased, as awareness about it increased. The initiatives that were successful and were agreed to within the present cultural tendency in Rome were those that were to everybody's advantage, i.e. people who used public transport and those who simply "breathe the city air", and that did not limit mobility and the use of private means.</p> <p>Pay-for -parking was the initiative that was least satisfactory in 2002 as well (even if its absolute value was higher than the average); in 2005 the satisfaction value dropped below the satisfaction average. The satisfaction value of access-restricted areas also dropped markedly.</p> <p>This did not mean that these initiatives should be discontinued. They should be publicised with emphasis placed on the advantages for everyone, hence removing privileges and improvisation in sanctions.</p> <p>The cultural segmentation of the Roman population differentiated markedly within the levels of satisfaction with the initiatives of the MIRACLES project.</p> <p>This means that an action to improve satisfaction must take into account the different cultural areas into which the Roman population was subdivided.</p> <p>The mistrust and anarchy CP values were invariably below the average; the values of the control CP were higher and always above the average; both the efficiency and trust CP values were about the average.</p> <p><i>Conclusions</i></p> <p>The most significant change verified in the Culture of traffic between the years 2002 and 2005, was the decrease of the Control Cultural Pattern and the increase of Anarchy Cultural Pattern.</p> <p>This was an important variation, since it stressed an increase of "individualism" that is intolerant of rules and the limitation of the use of private transport; a comparable decrease in those who want rules and controls for promoting the use of public transport.</p> <p>In the Anarchy CP, the power in the traffic was entrusted to individuals and their capacity to assert themselves one against the other, and everyone against any regulatory initiative proposed by administrators. If left to themselves, without any regulations, Romans, in this culture, would know how to do the best for themselves and create chaotic, but efficient traffic. The obvious favourite mode was the private one, particularly motorbikes; these people were indifferent to the development of public transport; attention was only paid to initiatives concerning the road network and they were pessimists about the evolution of the traffic, which was increasingly problematic, and about Public Administration initiatives.</p> <p>On the contrary, the Control CP called for restrictions and limits to private means, which would be a solution to a conflict that the capricious Romans produce in city traffic. Here the solution of public transport were seen as the only answer to the traffic problem: public transport with improved efficiency and comfort. Accordingly, the problem was a matter of convincing even the most intractable people to use public transport, by severe actions, with the objective of discouraging the use of cars and motorbikes. These were people who would like to see a limit to the traffic, who thought about their fellow citizens, i.e. those who were too individualistic and did not respect the rules, thus causing problems in traffic and in community life. They trusted the municipal administration, as a service agency for the citizens. They hoped for more authoritative, less permissive city police officers.</p> <p><u>Accessibility indicators</u></p> <p>For what concerns accessibility indicators, the increase of provision for disabled people was clear; it must be also stressed its wider extent to meet requirements for all physically-challenged users, sight-impaired people included. Also for what concerned access to service via media, the increase was evident, thanks to an increase of about 30% of visitors. The availability of devices for tourists has improved as well, being 5 kiosks available and a multilingual website at disposal.</p>	
Lessons Learned – what do other cities, other actors and the EC have to consider?	
C7: Lessons learned:	
<p>As already stressed, the significant increase in awareness– compared to the 2002 survey – of non-polluting public transport and flexible parking was interesting: two initiatives serving the public without limit obligations. In the same time, there was still a major awareness of initiatives which led to restrictions and costs for citizens</p>	

CITY-LEVEL RESULTS

Indicators group title: Awareness and accessibility levels

Project: MIRACLES

Indicator number: 13 Awareness, 14 Acceptance (METEOR Core Indicator #)

City: Rome

Evaluation Area: Society

If the classification of satisfaction is analysed, it was easy to see that the highest values concerned dimensions and initiatives that *did not entail limitations in the behaviour of individuals in traffic* (non-polluting transport, telematics). In the classification of satisfaction, the last item was an initiative that resulted in a considerable limitation in the behaviour of the individual in traffic (pay-for-parking). A similar observation can be made for access restrictions.

Why was satisfaction with these last two categories significantly higher in 2002?

The reason for this may be related to the change in local culture related to traffic in the city of Rome during the period being considered. In particular, as was just seen and regarding the population, there was a drop in the Cultural Pattern of Control and an increase in the Cultural Pattern of Anarchy between 2002 and 2005.

If the clusters are analysed in detail:

Cultural Index 1: CONTROL, decreased if compared to the 2002 survey

This model enhanced the city, in particular residential areas. There was confidence with the reliability of Public Administration (schools, health services and law enforcement) and families were relied on as a system of socialisation

Traffic in Rome worsened as a result of personal behaviour, especially because of those Romans who used their cars to show off and for fast driving. Hence, the traffic in Roma *must be limited*. How? Through the intensification of *controls and fines on private transport*.

This is why Municipal Government initiatives aimed at limiting traffic, blue zones, pay- for-parking and pedestrian zones were accepted for their usefulness.

Cultural Index 2: confidence

In brief, the opposition between the reliability of city Administration and mistrust in the inhabitants of the city appeared interesting. This Administration was implementing credible, useful initiatives and was capable of taking advantage of future events. As far as Romans are concerned, the method of control and penalties in the culture being examined would not seem as useful as that of promoting the culture and improving public transport, two tools for creating civility and the competency to coexist.

Cultural Index 3: ANARCHY, increased if compared to the 2002 survey

There was no confidence in the Municipal Government, which was due more to the general mistrust in institutions than to a specific, targeted assessment. The innovations put forward concerning the traffic were strongly refused: they were neither objectively useful nor are satisfactory for the participants in the surveys. The latter had to travel during rush hour and were in a position of frustration and obligation. They may also be a bit concerned about the environment and its quality. Otherwise, they counted on personal initiatives, in the ability of acquiring what was necessary, without having to trust in public institutions; this freedom of personal initiatives, "anarchic" for being very little or not at all anchored to the principle of the public institution or informal references, seemed especially facilitated in Rome.

Cultural Index 4: EFFICIENCY

These people lived in central and semi-central areas of the city, so they were well served by the public transport, which they use frequently. They used to move "on foot" and are not participants to the city planning. This was a minority of the population that tended to use its own lobbying force to protest against the inefficiency of public transport and ask for precise supervision; this culture was typical of people disillusioned and not very emotionally involved in the *complaint*; in some way, they were "using" the survey to ask for road and public transport efficiency; this efficiency can be pursued by an attentive administration, which had already proved itself through blue zones and pedestrian zones (not with pay-for -parking, which did not interest people who use public transport or walk).

Cultural Index 5: MISTRUST

This was a particularly problematic culture of mistrust in the so-called preconception against every possible "public" initiative for regulating coexistence: the deep-rooted conviction of this cultural group was that the rules of the game are useless, owing to the deep mistrust in both the people formulating them and the people who should use them to coexist. Hence, a request for "liberalisation" that seemed more founded on desperation and indifference than trust in the initiative of individuals. Indeed, the only "realistic" request of this CP seemed to be to identify themselves in the authoritativeness of the traffic police, who were entrusted with regulating the *deregulation*. All this happened in a city that can do nothing but deteriorate, and which it would seem necessary to leave.

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27. City-level Results - Transport

CITY-LEVEL RESULTS	
Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #) Evaluation Area: Transport	Project: MIRACLES City: Rome
<i>The Indicator – what is it about?</i>	
C1: Local objectives and quantifiable targets:	
<p>Because of the various measures to be implemented in Rome, and consequently of the manifold goals to be achieved, the selection of parameters to assess such interventions led to assume a vast range of transport indicators. Such typology of indicators was used for all the infrastructural measures foreseen in the MIRACLES project.</p> <p>Indicators that were selected from the METEOR Core indicators list were the classical ones: modal split, traffic levels, average speed, journey time, but it was necessary to introduce new ones, more tailored to the measures peculiarities, also to assure a control on the achievement of local objectives. These indicators were: n° of trips, n° of pay for parking lots, n° of bays for deliveries, n° of routes, n° of travelled people, n° of real time information panels on board, total amount of km, average time for reaching workplaces, n° of participants per company (see their application at section C5).</p> <p>As mentioned above all indicators were selected in relation to local objectives, in terms of traffic and environmental safeguard; in particular the related to transport ones were:</p> <p><u>In the LTZ (Limited Traffic Zone)</u></p> <ul style="list-style-type: none"> • Reduce private traffic flows by 4%; • Reduce space for private cars by 2%; • Increase e-vehicles PT fleet by 20%; • Increase purchase of e-scooters by 10% <p><u>In the Demonstration Area</u></p> <ul style="list-style-type: none"> • Reduce not authorised entrances in LTZ, Trastevere and San Lorenzo by 30%; • Increase car pooling users up to 1.000; • Increase Mobility Managers nominations by 15%; • Reduce transport related emissions by 5%; • Increase walking by 5%; • Increase collective vehicle occupancy by 20% 	
C2: Indicator description:	
<p>Because of the high number of indicators, these could be grouped into:</p> <p><i>Transport indicators – changes in traffic</i></p> <ul style="list-style-type: none"> • Modal split: the percentage of vehicle and passenger km per year that was carried out by each transport mode. This indicator, besides it values at urban level (whole city + Rail ring area) was also specifically re-calculated for assessing the same percentage due to the introduction of Taxibus (measure 7.4) and to Home-to-work plans (measure 10.2) • Traffic levels: no. of daily trips per vehicle at urban level • N° of trips: total amount of trips for both the whole city and the Rail ring area • Average time for reaching workplaces: home to work trip time, in minutes, for participants to the Home-to-work plans (measure 10.2) • Participants per company: the percentage of employees participating to the Home-to-work plans (measure 10.2). These indicators were meant to describe the mobility management tests, concerning the Home-to-work plans developed for two public companies. <p><i>Transport indicators – changes in parking</i></p> <ul style="list-style-type: none"> • Pay for parking lots: number of on-street pay for parking lots • Pay for parking lots related to P&R: number of pay for parking lots available at P&R facilities; it integrated information coming from indicator on travelled people (see indicators on public transport). • N° of bays: number of on-street load/unload areas <p><i>Transport indicators – Public Transport</i></p> <ul style="list-style-type: none"> • N° of trips per line: total amount of trips each PT line run daily; the same indicator was used also for the taxibus measure (7.4) • N° of routes: total amount of new routes due to the improvement of transit, respectively for the existing PT service in general (measures 5.1, 6.1, 5.2), for clean vehicles(12.1) and also for the taxibus measure (7.4). 	

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

- Journey time: assessment of journey time for PT routes, considered for the same measures of indicator “n° of routes”, above.
- Travelled people: n. of passengers related to transit new services (7.4, 8.1, 12.1);
- Average speed: average speed per vehicle type, used in particular to assess the congestion impacts on transit (measures on PT and taxibus)
- Real time information panels on board: total amount of real time information devices on PT
- Total amount of km: total length of trips for measure 7.4
- Daily Availability of the vehicle (measure 12.1): percentage of daily service of each vehicle.

Transport indicators – Safety

- Number of fatalities: number of fatal accidents in the demonstration area.

C3: Context and relevance:

Congestion, energy consumption, pollution and the need to increase transport systems sustainability were top priorities to be solved in Rome, since ever. In particular, in recent years, the environmental safeguard as well as the adoption of integrated strategies to fight congestion phenomena became more and more main issues in the local political agenda. Two were the general trends that were followed up to now: on the one hand, to control air and noise pollution rates in the city in order to safeguard public health by emergency measures, on the other hand to start implementing long-term integrated actions particularly linked to the improvement of Public Transport in order to reduce progressively the number of private cars running in the city and the related pollution.

The above public transportation supply was not able to properly meet the demand, being very simple and traditional: a large bus network and just two metro lines, as showed in the Table 1:

	Buses	Tramways	Metro	Total
<i>Network in km</i>	2,510	51	37	2,598
<i>No. of lines</i>	279	6	2	287
<i>Vehicles km/year [10⁶]</i>	113	6	29	248
<i>No. of vehicles</i>	2,603	150		2753
<i>No. of trains</i>			79	79
<i>Passengers/years [10⁶]</i>	822	81	245	1208

Table 1- Rome’s Public Transport main figures (year 2000)

In past years, the transit poor supply compelled Rome citizens to become addicted to private vehicles, increasing the number of cars, mopeds and motorcycles. Moreover, the hilly morphology of the city does not help in supporting non motorized modes of transport. In addition, most of the private vehicles were quite old, low efficient and highly pollutant; The modal split, hence, did not vary in the last decade, and according to Rome Municipality data, in 2000 was as reported in Table 2.

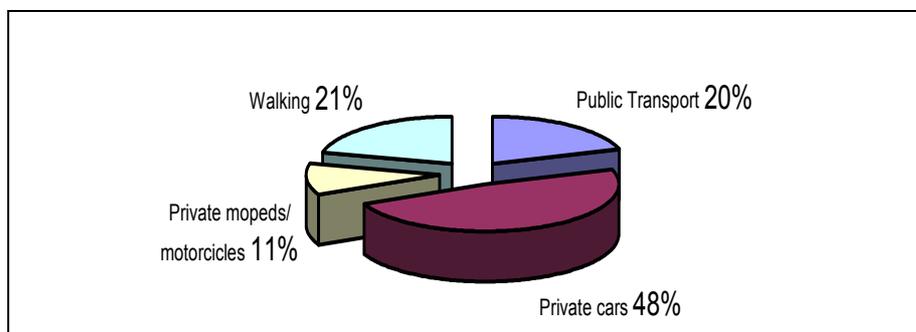


Table 2 – Modal Split in Rome in 2000

This aspect became particularly severe in the city centre where pollution due to congestion affected negatively not only citizens’ health but also the state of conservation of historical ruins, monuments, parks, landmarks and more in general the city economy.

Facts above listed become more impressive if linked to the trend of the motorization rate (indeed, even if the

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

motorization rate was not selected among the indicators, it is worth to be described because of its relevance in the urban pattern). Rome's rate, including two wheels, is one of the highest in Europe, with a current index around 950 (no. of vehicles/no. of inhabitants x 1000); this index, during 1989-1995 had an 11% increase and underwent a sudden rise after the law about auto scraping (a bonus was granted for old cars scraped and for the contemporary purchase of new ones). It is also interesting to underline that such a high car "density" goes hand in hand with high values for two wheeled vehicles, since the related index rose from 191% (1999) to 198 % (2000).

Figures on the current fleet size are provided in Table 3:

<i>Type of vehicle</i>	<i>No.</i>
<i>Cars</i>	<i>1,853,546</i>
<i>Commercial vehicles</i>	<i>102,117</i>
<i>Two wheels</i>	<i>514,766</i>
<i>Total</i>	<i>2,470,429</i>

Table 3 - Rome Municipality Area Vehicles Fleet Size (year 2000)

According to this situation, the choice of indicators was aimed mainly at monitoring the congestion phenomenon and its needed decrease due to the application of the MIRACLES measures. The consideration that congestion is however difficult to measure in a homogeneous way required that besides classical indicators as modal split, which usually depicts travel habits and enables comparisons among the different modes, other indicators, more customized to each measure, could be implemented. This explains the selection of indicators reported in section C2 and why some indicators are recurring, referred each time to single measures.

The Evaluation –what are the results?

C4: Method of measurement:

All methods used to calculate values of indicators are reported below. Since methods used to calculate the same indicator could change from a scenario to another, methods are separately reported for the two phases.

Ex ante phase

Baseline

A big part of information mainly quantitative was obtained thanks to 2001 National Census data and facts and figures collected before, after and during the 2000 Jubilee. For this event esteems, models, surveys, measurements on the most relevant spots were run in order to quantify and to check impacts as the changes of traffic, of parking and of the Public Transport service. Such surveys were repeated after the 2000 Jubilee event thanks to other occasions, as other special events or other EC projects involving Rome; in particular PROGRESS allowed to have more recent data on the traffic situation for the Traffic Limited Zone (ZTL). Besides that, information coming from the Environmental Department of the Rome Municipality, especially from the yearly report on the air quality status in the city, were used.

For what concerns Public Transport, the ATAC "infopoint" (a GIS based database) continuously provided information on the service.

Methods in details are as follows:

Transport indicators – changes in traffic

- Modal split: data were collected thanks to surveys, models; information on customers mobility, also published in the annual Report on the city mobility
- Traffic levels: provided by databases and models to collect information on traffic levels; counts on field to calibrate the traffic; data published in the annual Report on the City Mobility and Air Quality Report on the city status
- N° of trips: provided by databases and models to collect information on traffic levels; counts on field to calibrate the traffic; data published in the annual Report on the City Mobility
- Average time for reaching workplaces and Participants per company: data coming from a database based on interviews to employees

Transport indicators – Changes in parking

- Pay for parking lots: STA database published on the STA parking Annual Report
- Pay for parking lots related to P&R: STA database
- N° of bays: Rome municipality database, published on the Report on Freight Transport in the LTZ

CITY-LEVEL RESULTS

<p>Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities</p> <p>Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)</p> <p>Evaluation Area: Transport</p> <p><i>Transport indicators – Public Transport</i></p> <ul style="list-style-type: none"> • N° of trips per line, N° of routes, Travelled people, Real time information panels on board: ATAC Planning Dept. database • Journey time, Total amount of km: Information came from ATAC database for what concerned buses, as results of data reports by the drivers • Average speed: traffic model data <p>Same indicators for collective taxis were based on collection of data by collective taxi operators along with surveys on board.</p> <p><i>Transport indicators – Safety</i></p> <ul style="list-style-type: none"> • Number of fatalities: because of the difficulties to refer these data to the MIRACLES measures, this indicator was probably not the best “tool” to describe appropriately how new measures could affect safety in a given urban area; indeed, usual methods of surveys and of processing data refer accidents to infrastructure, weather, misbehaviours, etc. but not to the policy and to the related applicative measure in force where they occur. However, since the accidents rate is a very relevant indicator in terms of quality of life, this indicator was specially referred to fatalities due transportation in the city area, as provided by the UITP Millennium Database; such value had to be integrated by a more popular, though general, indicator, i.e. the number of accidents per year, which was in Rome 24887, according to 2001 ISTAT – National Institute of Statistics data. Given the not complete appropriateness of this indicator, it was used only for measures 5.1 and 5.2. <p><u>Do-nothing</u></p> <p>To evaluate the variation of indicators of transport in the Do-nothing scenarios ITEMS was used. ITEMS is the so-called custom-tailored model for the production of estimations; it is, hence, a model to evaluate and support decisions on policy measures in the field of urban transport, focused in energy efficiency and environment. It assess technologies and policies in terms of their effects on energy, environment and economy. Big efforts were in adapting available information to the input data requested by the model.</p> <p>In particular, results provided by ITEMS were also revised to homogenize them with the units used for the baseline values.</p> <p>The data situation of the city, allowed ITEMS to provide two different versions of the “do-nothing” scenario:</p> <ul style="list-style-type: none"> • A “Frozen” version • A “Trend” version, according to METEOR (2003) ‘D2 – ‘Assessment framework and evaluation guidelines for data collection’ and METEOR (2003) ‘D3 – ‘City reference for evaluation’ <p>In particular, relevant data provided by the local partners to ITEMS were:</p> <p><i>Topic: transport equipment of households</i></p> <ul style="list-style-type: none"> • Car equipment: owned or at disposal • Stocks of vehicles (cars, buses, coaches, trucks, light vehicles) <p><i>Topic: The urban traffic</i></p> <ul style="list-style-type: none"> • Density of traffic (in vehicle per hour) • Share of vehicles by fuels (in %) • Number of vehicles in traffic • Maximum speed authorized • Average speed in town for cars • Average distance travelling in town (zone1+2) by mode and by year <p><i>Topic: Trips</i></p> <ul style="list-style-type: none"> • number of trips (per year) and share of trips per scope <p><i>Topic: distance</i></p> <ul style="list-style-type: none"> • access/egress time <p>ITEMS exercise provided values for both trend and frozen scenarios for the following indicator: modal split, trips, travelled people. Such values were revised and re-elaborated to double-check the suitability of the provided values and to determine, when possible, the missing values for the remaining indicators.</p> <p>For what concerned indicators not directly defined by the ITEMS results, they were calculated as follows:</p>	<p>Project: MIRACLES</p> <p>City: Rome</p>
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CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

*Traffic level (Trips/day*vehicles):* it was obtained starting from data provided for ITEMS on: vehicles*km/day, pers*km/pers*day and trips/day. From the product between trip/day and (vehicles*Km/day)-1 it was obtained trip/vehicles*km. Hence Trips/day*vehicles was achieved from product between trip/vehicles*km and pass*km/pers*day.

Do-something

To perform scenarios simulations a specific traffic simulation programme, TransCad, was used, to develop a specific modal share model.

TransCad is a full-featured Geographic Information System (GIS) designed specifically for planning management, and the analysis of transport systems.

Therefore, the use of TransCad and its specific models, allowed to perform scenario simulations aiming at evaluating the impacts of:

1. new access regulatory acts;
2. new access control systems (both for simulating impacts related to measure: (5.1 set up of city centre clean zones)
3. different road pricing policies (to simulate measure: 6.1 road pricing policies)
4. introduction of different parking tariffs (to simulate measure: 6.2 flexible parking policies)
5. Low emission buses and new line (to simulate measures: 7.3 new line and 12.1 clean buses)

For what strictly concerned the transport indicators, and hence effects due to measures of points 1 and 2 listed above, the do something scenario was created as follows:

New access regulatory acts: to assess the impacts of this measure a comparison was carried out between the vehicular fleet renewal trend and the renewal ratio due to the implementation of the regulatory acts. This allowed to determine the number of new cars to fit the access restriction limits set by the regulatory acts. Then, the application of the TransCad software allowed to determine the average length of trips within the area so benefits, in terms of congestion reduction, were determined.

New access control systems: To assess the impacts of these access control systems the TransCad software was used to determine the new flows distribution and modal split.

For the sake of brevity, being the modelling methodology very complex, only the procedure to simulate access restriction is reported as follows. Details are described in the "Ex ante working note", available on the restricted area of the MIRACLES web site.

To simulate access restrictions results two O/D matrices representing authorised and not authorised car users trips and access rules to LTZ were considered. The model was based on user equilibrium multi-class (i.e. the two classes authorised and not authorised car users) assignment procedures, where travel time of each link in the network was calculated iteratively with specific link performance functions.

The private transport graphs and the O/D matrices were supplied by STA and elaborated by DITS.

The supply model. For the supply model the whole Rome urban area was taken into account. The network was based on a graph of 4861 links and 3367 nodes. The link performance functions used in the model were in BPR (Bureau of Public Roads) formulation, where travel time on a link was a function of the link capacity and the traffic condition, i.e. the number of vehicles travelling on the link.

The demand model. The used model was based on a subdivision of Rome urban area in 495 traffic zones corresponding to 495 centroids. For ACS simulations four modal O/D matrices, estimated by STA, representing trips in the period from 21:00 to 22:00 were used. These four matrices were related to four modal alternatives: car (A), public transport (TP), motorcycle/moped (M) and walking (W). The number of non resident authorised car users was estimated as 25% of the total accessing vehicles. This percentage was calculated on the basis of a survey on the number of commercial facilities in S. Lorenzo and Trastevere areas (measure 5.1),. In Tridente simulations (measure 5.2), the morning peak hour was taken into account. Two matrices, supplied by STA, were related to vehicles with and without permit to access the LTZ of Rome historical centre.

For measure 9.1 *Kerbside-doorstep delivery*, the definition of the do-something value for the number of bays for loading and unloading operations was achieved thanks to a simulation in which a coefficient, developed on this purpose evaluated daily attractiveness of commercial vehicles in relation to the commercial facilities to serve. The value of this coefficient varied with each kind of commercial activities, and it was obtained processing information coming from interviews to retailers.

Ex-post phase

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

In this phase data were collected in the same way of the baseline process so to have “before and after” homogeneous facts.

C5: Achievement of quantifiable targets:

A comparison among indicators values, according to the ex ante and ex post phases is provided below (Tables 1); values for the do-something scenario, being developed for single measures, are reported separately as a comparison between do-nothing and do-something scenarios (Table 2).

Ex ante (do something scenario excluded) – Ex post phases

Transport indicators – Changes in traffic								
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Tran.1.a R5.2/Tran.1.a R6.1/Tran.1.a R8.1/Tran.1.a	21/22	modal split (motorized and non motorized) (% of the total flow)	1) a) 20 b) 48 c) 11 d) 21 2) a) 30 b) 27 c) 23 d) 20	1) a) 22 b + c) 53 d) 25	1) b) 22 b + c) 53 d) 25	1) c) 22 b + c) 53 d) 25	1) a) 18 b) 47 c) 8 d) 27 2) a) 31 b) 22 c) 24 d) 23	1)whole city 2)Rail Ring Area a) PT b) Priv. 4 wheels c) Priv. 2 wheels d) walking * +2million vkm/year made with electric mode
R5.1/Tran.1.b R5.2/Tran.1.b R6.1/Tran.1.b	21/22	traffic levels (trips day per vehicle)	2,2	2,5	2,5	2,5	2,5	
R8.1/Tran.1.b	21/22	traffic levels (trips per vehicle)	2,2	2,5	2,5	N/A	car pooling: 2,0 car sharing: 1,12* 0,44**	* at the beginning of the implementation **Consolidated average value
R10.2/Tran.1.b		average time for reaching workplaces (min.)	Home to work plan Sapienza: 50 min Home to work plan TIM: 43 min				31,125 min	Elaborations and hypothesis by STA in the period 2000-2001 No variations foreseen for frozen and trend scenarios
R10.2/Tran.1.c		participants per company (%)	Home to work plan Sapienza: 550 potential users (9,4% employees) Home to work plan TIM: 140 potential users (13,8% employees)			Home to work plan Sapienza: 548 potential users (9,4% empl.) Home to work plan TIM: 141 potential users (13,8% empl.)	Total average users per company: 41.805 (2,7% of total participants)	Elaborations and hypothesis by STA in the period 2000-2001 No variations foreseen for frozen scenario Do-something values: Home to work plan Sapienza: 550 potential users+2279 yet using PT system Home to work plan TIM: 140 potential users+112 yet using PT system
R5.1/Tran.1.c R5.2/Tran.1.c R6.1/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42	1)4,8 2)1,53	1)4,8 2)1,53	1)4,9 2)1,55	1) 6.1 2) 1.5	1)whole city 2)Rail Ring Area
R8.1/Tran.1.c		trips (Millions no.)	1)5,6 2)1,42	1)4,8 2)1,53	1)4,8 2)1,53	1)4,9 2)1,55	0.00015 0 (c.pooling) 0.00001 2* 0,0021**	* at the beginning of the implementation **Consolidated average value

Table 1 – Comparison between ex ante and ex post phases, changes in traffic

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

Transport indicators – Changes in parking								
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R6.1/Tran.2.a		pay for parking lots (increase/decrease) (no.)	52000			65006*	75000	* Re-elaborated from data provided to ITEMS by supposing improvement of 5% /year (roughly) from 2001 No variations foreseen for frozen scenario
R6.2/Tran.1.a		pay for parking lots related to P&R (no.)	10214			11624*	12089	No variation foreseen for frozen scenarios * Re-elaborated from data provided to ITEMS
R9.1/Tran.1.a		bays for deliveries (no.)	183			201*	190	Each bay can have more than 1 load/unload lot (total number of lots 197) No variations foreseen for frozen * Re-elaborated from data provided to ITEMS by supposing improvement of 10% of bay in trend scenario Do-something value: 643

Table 2 – Comparison between ex ante and ex post phases, changes in parking

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

Transport indicators – Public transport								
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Tran.3.d R6.1/Tran.3.a		Trips per line (no./day)	206				206 express 109 electric	No variations foreseen for frozen and trend scenarios
R7.4/Tran.3.a		Trips (no per day.)	160		160		752	Data from january to june 2003 No variations foreseen for frozen and trend scenarios Do-something value: 624
R5.1/Tran.3.a R5.2/Tran.3.a		Routes (no.) (clean vehicles only)	2				5+1	No variations foreseen for frozen and trend scenarios
R6.1/Tran.3.b R12.1/Tran.1.a		Routes (no.) (clean vehicles only)	1				5+1	No variations foreseen for frozen and trend scenarios
R7.4/Tran.3.b		new routes (no.)	1		1		8	From june 2003 Do-something value: 7
R6.1/Tran.3.c	18	Journey time (min) (clean vehicles only)	17				50*	No variations foreseen for frozen and trend scenarios * Increase in lines quantity and lines length
R5.1/Tran.3.b	18	Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				50	No variations foreseen for frozen and trend scenarios
R5.2/Tran.3.b R7.3/Tran.1.a	18	Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				40' electric buses 55' trolleybus (+6 min. stop at the line terminal) duty time: 5.30-24.30	No variations foreseen for frozen and trend scenarios
R7.4/Tran.3.d	18	Journey time (min)	60		60		20	Data from january to june 2003 No variations foreseen for frozen and trend scenarios For do-something: average value is 53,8 min (round trip).
R6.1/Tran.3.d R12.1/Tran.1.b		travelled people (no./day.) (clean vehicles only)	370				10000/12000 pax/day electric buses 32000 pax/day trolleybus	No variations foreseen for frozen and trend scenarios
R5.1/Tran.3.c R5.2/Tran.3.c R7.3/Tran.1.b		travelled people (no.)	16000/17000		15944/16941	16167/17178	10000/12000 pax/day electric buses 32000 pax/day trolleybus	*Re-elaborated from data provided to IITEMS

Table 3 – Comparison between ex ante and ex post phases, changes in public transport

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

Transport indicators – Public transport									
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes	
R5.1/Tran.3.d R6.1/Tran.3.a		Trips per line (no./day)	206				206 express 109 electric	No variations foreseen for frozen and trend scenarios	
R7.4/Tran.3.a		Trips (no per day.)	160		160		752	Data from january to june 2003 No variations foreseen for frozen and trend scenarios Do-something value: 624	
R5.1/Tran.3.a R5.2/Tran.3.a		Routes (no.) (clean vehicles only)	2				5+1	No variations foreseen for frozen and trend scenarios	
R6.1/Tran.3.b R12.1/Tran.1.a		Routes (no.) (clean vehicles only)	1				5+1	No variations foreseen for frozen and trend scenarios	
R7.4/Tran.3.b		new routes (no.)	1		1		8	From june 2003 Do-something value: 7	
R6.1/Tran.3.c	18	Journey time (min) (clean vehicles only)	17				50*	No variations foreseen for frozen and trend scenarios * Increase in lines quantity and lines length	
R5.1/Tran.3.b	18	Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				50	No variations foreseen for frozen and trend scenarios	
R5.2/Tran.3.b R7.3/Tran.1.a	18	Journey time (min.)	94 (+6 min. stop at the line terminal) duty time: 5.30-24.30				40' electric buses 55' trolleybus (+6 min. stop at the line terminal) duty time: 5.30-24.30	No variations foreseen for frozen and trend scenarios	
R7.4/Tran.3.d	18	Journey time (min)	60		60		20	Data from january to june 2003 No variations foreseen for frozen and trend scenarios For do-something: average value is 53,8 min (round trip).	
R6.1/Tran.3.d R12.1/Tran.1.b		travelled people (no./day.) (clean vehicles only)	370				10000/12000 pax/day electric buses 32000 pax/day trolleybus	No variations foreseen for frozen and trend scenarios	
R5.1/Tran.3.c R5.2/Tran.3.c R7.3/Tran.1.b		travelled people (no.)	16000/17000		15944/16941	16167/17178	10000/12000 pax/day electric buses 32000 pax/day trolleybus	*Re-elaborated from data provided to IITEMS	

Table 3 (cont.) – Comparison between ex ante and ex post phases, changes in public transport

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

Transport indicators – Safety								
MIRACLES number	METEOR number	Indicator (Units)	Value Base year	Value ITEMS Baseline	Value ITEMS Frozen	Value ITEMS Trend	Ex-post Value	Notes
R5.1/Tran.2.a R5.2/Tran.2.a	20	Number of fatalities (deaths./10 ⁸ inh)	115,29				65,33	No variations foreseen for frozen and trend scenarios Base year and ex-post values referred to Whole city

Table 4 – Comparison between ex ante and ex post phases, changes in safety

Do-something scenario

As for the environmental indicators, most relevant targets in the MIRACLES scenario, under the transport point of view, were achieved by the application of the following measures: 5.1 set up of city centre clean zones, related to the application of ACS to the S. Lorenzo and Trastevere Areas and to the pedestrianization of the Tridente area; 6.1 – parking policy; 7.4 – collective taxis and eventually (even though just theoretically) 9.1 Kerbside-doorstep delivery.

The Access Control System - ACS implementation and the introduction of electric buses at S. Lorenzo and Trastevere Areas

Comparisons between “with and without” the ACS measure application are synthesized below, respectively in Table 5 for S. Lorenzo and in Table 6 for Trastevere, for what concerns modal split variation.

For both of these measures the evening peak hour was simulated from 21.00 to 22.00.

In the “without” scenario, all streets could be travelled. In the second scenario, the ACSs became operational and a modal split for trips ending in the areas was estimated.

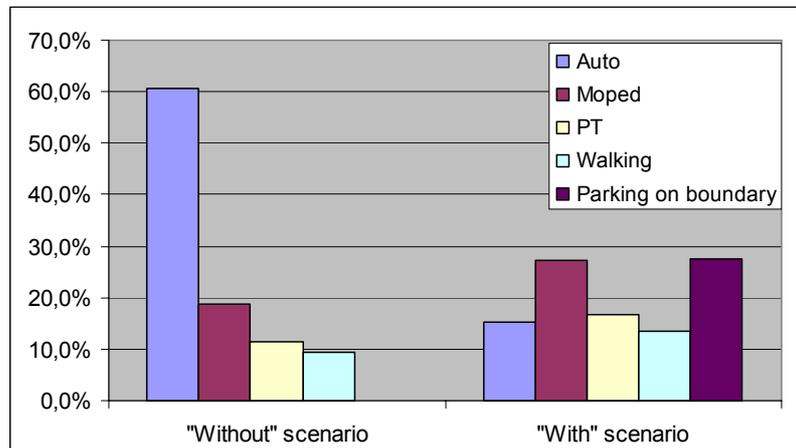


Table 5 - Modal split of trips to S. Lorenzo without and with access restrictions

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

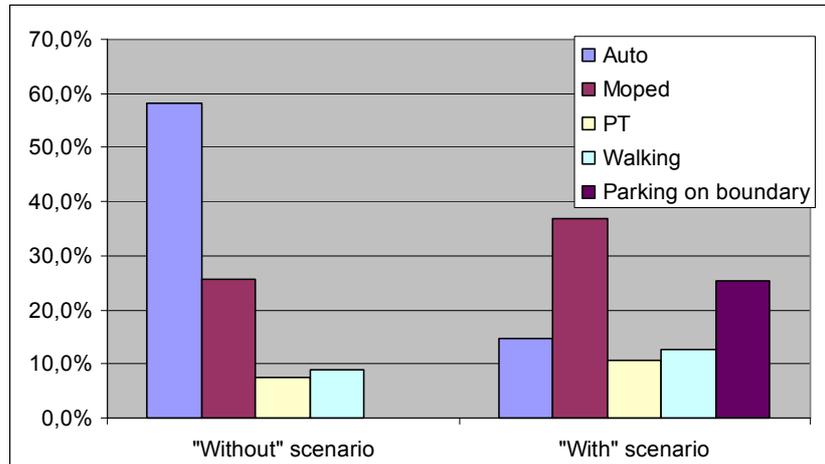


Table 6 - Modal split of trips to Trastevere without and with access restrictions

The Tridente pedestrianization

Two scenarios were taken into account: in the first scenario ("without" pedestrian area) only vehicles with permit to LTZ were admitted. In the second one ("with" pedestrian area) streets inside the pedestrian area could not be travelled. Both scenarios were referred to morning peak hour.

In table 7, total flows for main road sections inside or immediately outside the area are reported.

		Section	"without" scenario	"with" scenario	Difference (%)
Inside Tridente	1	Via del Corso	230	0	-100,0%
	2	Via del Babuino	266	0	-100,0%
	3	Via Vittoria	701	0	-100,0%
	4	Via Ara Pacis	588	0	-100,0%
	5	Piazza Augusto Imperatore	55	0	-100,0%
		Subtotal	1840	0	-100,0%
Outside Tridente	6	Via del Muro Torto	7847	7833	-0,2%
	7	Viale Trinità dei Monti	977	1051	7,6%
	8	Via di Ripetta	21	270	1185,7%
	9	Via Tomacelli	1245	1145	-8,0%
	10	Lungotevere Marzio	3275	3146	-3,9%
		Subtotal	13365	13445	0,6%

Table 7 - Traffic flows variation

Road pricing policies

The simulation activities focused on the results of the application of different road pricing schemes, each corresponding to a scenario; six scenarios were hence elaborated, in which the charging structure became progressively stronger, as reported in table 8.

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

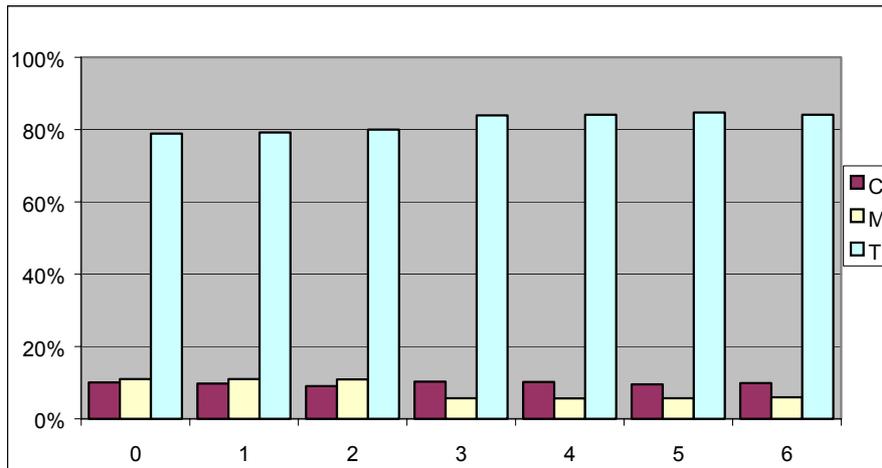
City: Rome

Evaluation Area: Transport

		Users Category and main attributes						
		Residents car users		Not –residents, authorized car users		Mopeds users		Others
		charging structure	fare level (€)	charging structure	fare level (€)	charging structure	fare level (€)	PT supply (average trip reduction)
Scenarios	0			Annual permit	300			
	1			Per trip	3			10%
	2	Annual permit	300	Per trip	6			20%
	3			Per trip	1,5	Per trip	1,5	10%
	4			Per trip	1,5	Per trip	1,5	20%
	5	Annual permit	300	Per trip	6	Per trip	1,5	20%
	6	Annual permit	300	Per hour	1,5	Per trip	1,5	20%

Table 8 - Summary of simulated scenarios

Modal split variations are reported in Tables 9 and 10.



Caption: C –cars; M – mopeds; T – Public Transportation

Table 9 -Modal split in scenarios 0 – 6 (morning peak hour)(No charge on moped)

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

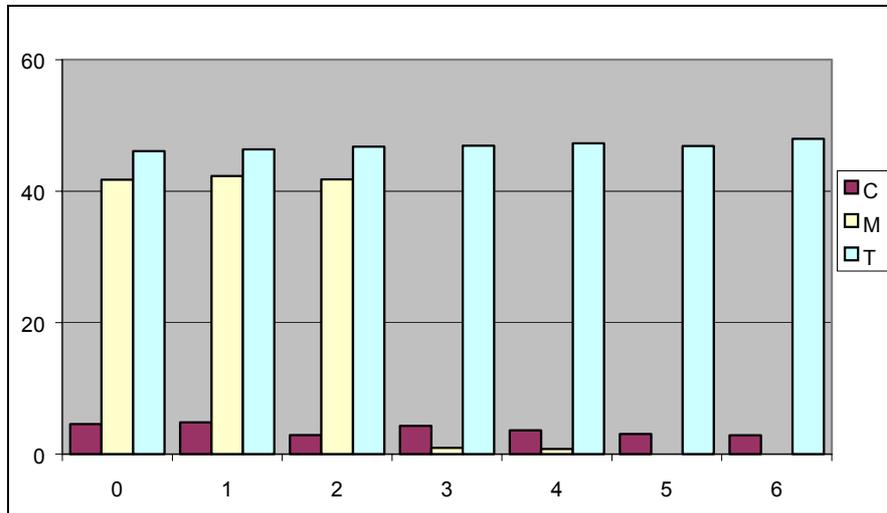
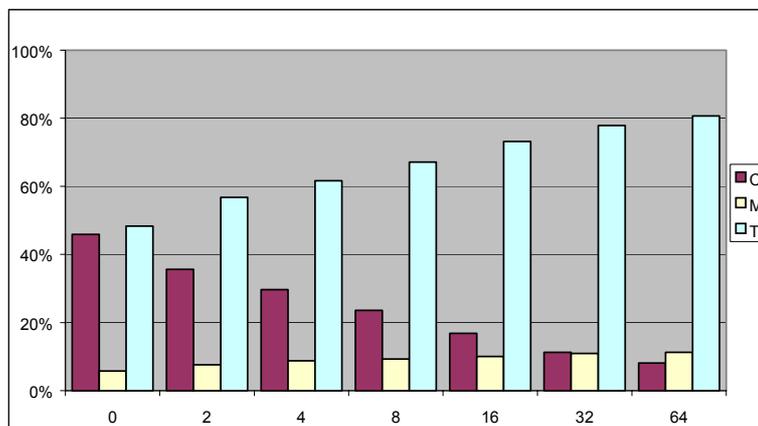


Table 10 - Percentage of through trips in scenarios 0 – 6 (morning peak hour)

Caption: C –cars; M – mopeds; T – Public Transportation

A scenario assuming the complete substitution of the current access restriction with a “pure” road pricing policies was also simulated, in order to check what would be the charge to apply, to have the same results currently achieved through the access restriction. Results on modal split are reported in Table 11.



Caption: C –cars; M – mopeds; T – Public Transportation

Table 11 - “Pure” road pricing application (morning peak hour)

Improved integration of PT (Collective taxis)

Data used for the development of this study came from a DITS internal report, in which a 3 years scenario to study operative feasibility of eight lines of collective taxis was created.

The translation of this forecast into indicators for the evaluation of this measure can be split in three impacts: Economy (indicator about cost for operating), Energy (efficiency indicators), and Transport indicators, considered both in general and per each line of service.

In table 12 results on transport indicators are reported for each planned line.

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities
Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)
Evaluation Area: Transport

Project: MIRACLES
City: Rome

N°	Route	length [km]	Commercial speed[km/h]	Journey time [min]	Travelled people [pass/day]	Travelled people [pass/year]	Frequency peak hour [Passage/h]	Frequency no peak hour[Passage/h]	Trips per day [no per day]	total amount of km [km per day]
1	Via Sappada Cso Francia	9,7	12,9	45	652	195600	10	6	100	970
2	P.zza Monteleone di Spoleto P.zza Aug. Imperatore	8,1	13,0	47	212	63600	4	2	36	291,6
3	L.go di Vigna Stelluti P.zza Aug. Imperatore	7,6	15,2	60	397	119100	6	4	64	486,4
4	L.go di Vigna Stelluti P.le Aldo Moro	8,1	16,2	60	492	147600	8	5	82	664,2
5	P.zza Monteleone di Spoleto P.le Aldo Moro	10	13,0	56	249	74700	4	3	46	460
6	Cassia (Due Ponti) Cso Francia	7,6	13,0	45	637	191100	10	6	100	760
7	L.go di Vigna Stelluti via di Grottarossa	10,80	13,0	60	717	215100	11	7	114	1231,2
8	P.le Aldo Moro P.zza Aug. Imperatore	10,5	13,0	58	497	149100	8	5	82	861
TOTAL		72			3853	1155900			624	5724

Table 12 - Do-something results for each line

Service operative for 14 hours/day for 300 days year. 4 hours peak service considered

Kerbside-doorstep delivery

As a sample, a representative street of city centre, in the Monti Area, Via dei Serpenti, was taken into account. The number of lots in the Miracles scenario highly increased as reported in Figure 1.

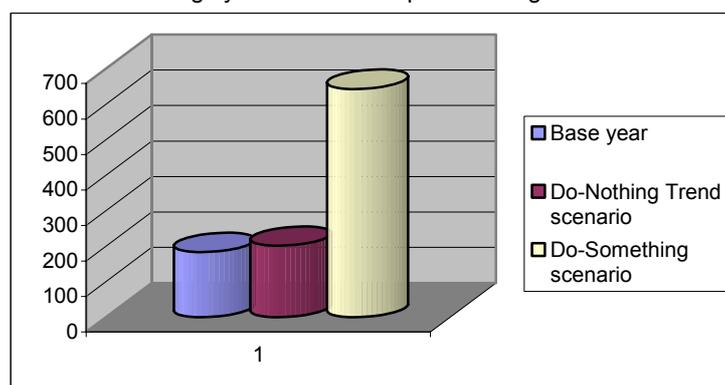


Figure 1- Increase of needed lots

C6: Report on results:

Results for what concerns mobility situations are positive and they are reported as follows:

Changes in traffic

The most important indicator was the modal split which, for what concerned the ex ante phase and in particular the comparison between baseline and the do-nothing study (including both trend and frozen scenarios) showed no appreciable variations related to measures 5.1, 5.2, 6.2, 7.4, 8.1. For measure 10.2 the recalculation of modal split for the two trials confirmed such trend. The lack of relevant variations between baseline and do-nothing scenario was due to the very short term of the forecasts (only four years). However, more relevant was the comparison between the baseline and the ex post values, just considering the mere relationship “before” and “after” the measures: if the whole city area is considered, no big diversions among the motorized modes can be recorded, but

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

for walking which increased from 21% to 27%; on the contrary, data related to the Rail Ring Area (in which all the measures are implemented) showed a big decrease in the use of private cars (-5%) in favour of walking (+ 3%) and of transit (+1%). Needless to say, most relevant measures causing such a change were the access restriction ones (WP5); this effect was also foreknown by the do-something scenario, where the local restrictions in S. Lorenzo and Trastevere areas showed similar trends.

Also “niche” measures as the Mobility Management contributed to improve the overall mobility pattern; the unexpected, strong increase in the number of participants to the Home-to-Work plans, exceeding any do-something/do-nothing forecasts (from less than 700 before, to about 42000 users after), confirmed the improvement of the transit share; such positive result went in hand with the reduction of travel time for reaching workplaces, decreased between 40 and 30 %, in average.

For what concerned the indicator on number of trips, it integrated both the number of travelled people for what concerned measures 5.1, 6.1, 8.1 and METEOR Core Indicators 21 and 22. Trips amount in the whole city and in the city centre were first provided as a reference datum for the year 2001 (5,6 millions for the whole urban area and 1,42 for the Rail Ring area) and then by ITEMS. A light increase was reported for the ITEMS Trend scenario for measures 5.1, 5.2, 6.1 and 8.1. In measures 7.4, no appreciable variation was foreseen for both scenarios. Indeed, data about trips/day in the city centre and in the whole city had few differences among the three scenarios. Referring to the whole city, in the baseline scenario there were 4.8 million trips/day, as in the frozen scenario, and in the trend one there was a small improvement of 0,1 million trips/day. Referring only to city centre, both in frozen and baseline scenarios there were 1,53 million trips/day and in trend scenario there were 1,55 million trips/day. Such data were confirmed by the ex post values, respectively 6.1 for the whole city and 1.5 for the Rail Ring Area. Reasons for this scarce difference were due to the supposed, modest socio-economic development which induced to forecast a limited improvement of trip/day. However, it is important to stress that in this case the do-nothing exercise produced underestimated values, not only if compared to the reference year ones, but also to what achieved after the measures implementation, since a 10% increase was recorded for both ex post values for the whole urban areas and the Rail Ring area. There were not univocal reasons for these results, but a mix of causes, as the synergy among: a different, real socio-economic trend (to the ITEMS supposed one), an increase of the overall traffic level and other external factors. Concerning the “traffic levels” indicator, the corresponding values for the car pooling and car sharing were 2.0 and 1.12, respectively. The latter result was considered quite impressive when viewed within the context of the short implementation timescale, but from a longer period of implementation (March 2005 – June 2006) 0,44 is reported as an average value.

Changes in parking

Parking supply strongly increased, exceeding what expected in the forecasts. Indeed, parking lots availability (assessed by the indicator “pay for parking lots”) increased more than 5% per year (theoretical increasing factor), as esteemed in the do-nothing scenario, so to achieve a final, “ex post” availability of 75000 lots, in comparison to the 65000 expected ones.

Focusing on the do-nothing exercise, for measure 6.2, variation in “pay for parking lots related to P&R” was supposed proportional, in the trend scenario, to the improvements of parking lots foreseen in Rome Municipality planning document “Patto della Mobilità”. In the frozen scenario, due to no relevant socio-economic trend, the number of “pay for parking lots related to P&R” did not change, whereas remarkable improvements concerned the trend scenario (more 20%) and the comparison before and after (roughly just more than 15%).

Since the measure 9.1 was focused on the development of a feasibility study for the rationalisation of loading/unloading areas, the indicator “bays for deliveries” represented the possible change of infrastructures for measure 9.1. In this case, since kerbside doorstep delivery: info and support service, was a soft measure, it is more relevant to focus on the do-something results. The improvement in the number of “bays for deliveries” in the do-nothing trend scenario was estimated in 10% for the four years, whereas in the frozen scenario, because of no socio-economic increase, the number of “bays for deliveries” couldn’t change. The do-something scenario, on its turn, stressed a bigger need of lots, due to the comparison between the place performances and the users needs (see dedicated template on the measure); if such requirements could be fully met and simply “translated” into new lots, the 2001 supply (i.e. 183 bays) should be septupled. This “magnification” however was not feasible for the Laboratory Area, where citizens requirements, historical features, social and cultural habits must be preserved as well. The need to meet/match both citizens and operators requirements reduced thence the number of parking lots into 643 units. This value had twofold facets: on the one hand, it simply stressed the total unsuitability of the former parking supply for loading unloading operations and the need to operate at infrastructural level; on the other hand, the need to start interventions to create platforms and transit points is becoming day by day paramount.

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

Another interesting result came from the do-something scenario on the parking policy, on which the effects of the introduction of flexible charges on on-street parking for the II District were assessed in terms of variations of modal choice. Under this point of view, outcomes from this analysis can be considered as the linking elements between changes in parking and changes in traffic. Just to summarize what reported in the dedicated measure template, the simulation was carried out developing four different scenarios, in which increasing charges were hypothesized (from scenario 0, free parking, up to scenario 4, 5 Euro/h charge). Results showed that the introduction of payment parking could produce a modal shift from private car to other transport modes (mopeds and public transport) that varied from a minimum of some 4% (scenario 1, 1 Euro/h charge) to a maximum of some 20% (scenario 4). Of this percentages, most of the users would move to public transport. Starting from scenario 1, the modal shift would almost double with a 2€/h rate (scenario 2). Scenarios 3 and 4 showed that the introduction of high parking tariffs (3 and 5€) could produce a very strong reduction in the use of private car, some 12% and almost a 20% reduction was foreseen, for each scenario respectively. Therefore, all scenarios showed that approximately 2/3 of the users could move to public transport.

Even though not directly assessable, by direct ex post measurements, these changes could be qualitatively detectable especially if considered in terms of change of behaviours. Indeed, payment parking can discourage users to drive around looking for an available lot or to enter a residential area to find a parking place, increasing the local through-traffic level. Not to forget that such changes, indirectly reducing the cars massive use, can positively affect the overall pollution level.

Public Transport

For what concerns indicators on transit, it is important stress two kind of comparisons; the baseline/do-nothing and do-something scenarios one and the before and after implementation one.

For the former, in general the comparison between baseline and do-nothing scenarios did not show relevant variations; in particular for indicators as “travelled people”, referred to clean buses only, or “New routes” or “Total amount of km” or “average speed” values could not change in the do-nothing scenario without a relevant change in modal split and because of a lack of infrastructural interventions; for other indicators, as “Real time information of panels on board”, or “travelled people” referred to measure 8.1, still no variations were appreciable, being linked to measures that at the base year were considered as trials or one-off interventions.

For other indicators changes were very small; for example, for the indicator “number of trips” referred to collective taxis, no appreciable variation was foreseen for all scenarios (baseline, trend and frozen). Indeed, data about trips/day in the city centre and in the whole city had few differences among the three scenarios, as already stressed when describing changes in traffic issues and it is still to remember that reasons could simply rely on the assumption of a modest socio-economics trend (because of the short period of simulation), which could produce a scarce improvement of trip/day.

For what concerned the comparison between before and after implementation, all the indicators showed a general improvement both for the “traditional” transit supply and for the new forms of collective transportation; for instance, for the former daily amount of trips per line increased by 53% (referred only to express and electric lines), for the latter the value passed from 160 to 752 units.

Travelled people increased remarkably (and this is consistent with the change of modal split, noted above), in particular, being the amount more than doubled for clean transit; for other niche measures as car pooling and car sharing, the sum of sharers almost doubled, too.

Transit average speed and journey times improved as well, the former not so relevantly, the latter in a more significant way, passing from an average of 94 minutes to 40 minutes (electric buses) to 55 minutes (trolleybuses). Collective taxis improved this performance as well, reducing by one-third the journey time.

The reliability of transit was measured by the survey on the daily availability (in %) of each kind of vehicle; most reliable vehicles seem to be the electric buses which achieve a score of 95% in comparison to trolleybuses which are available only for a 85%, after one year of implementation.

Safety

The number of fatalities, as collected for the base year, and the ex post values could be a reliable indicator in terms of safety, but some factors induced the evaluators to re-assess its worthiness for the city of Rome. Indeed, because of the difficulties to refer safety data to the MIRACLES measures, this indicator was probably not the best “tool” to describe appropriately how new measures can affect safety in a given urban area; usual methods of surveys and of processing data refer accidents to infrastructure, weather, misbehaviours, etc. but not to the policy and to the related traffic measure in force. So any link between accidents features (black spots, involved people, etc.) and enforced traffic measures could be tackled only according to a theoretical approach. However, since it is

CITY-LEVEL RESULTS

Indicators title: modal split, traffic levels, average speed, journey time, number of fatalities

Project: MIRACLES

Indicator number: 22, 21, 23, 24, 18, 20 (METEOR Core Indicator #)

City: Rome

Evaluation Area: Transport

undeniable that the accidents rate is a very relevant indicator in terms of quality of life, this indicator, for the Rome case study, was specially referred for the baseline to fatalities due transportation in the city area, as provided by the UITP Millennium Database; such value was integrated by a more popular, though general, indicator, i.e. the number of accidents per year, which was in Rome 24887, according to 2001 ISTAT – National Institute of Statistics data. Accordingly to such consideration, it seemed to be more sensible, besides simply comparing ex ante/ex post values, to assess also in general which consequences in terms of safety could be originated not simply by the implementation of the measures but by the change of habits, among the citizens, due to such implementation. Do-something simulations on access restrictions were very useful to make such changes evident: in all the restriction scenarios the shift of some car users to mopeds was obvious, because of the popularity and of the cheapness of the latter mode. The plain consequence of such change of habit was an increase of KSI factor (Killed and Seriously Injured), being mopeds much more dangerous than cars.

However, switching from theory into actual facts a general improvement could be recorded when “before and after” situations were considered: the accident rate decreased strongly (quite the half) but reasons could not be related only to the measures restrictiveness or rigorousness, but also to the enforcement of new severe regulations for drivers.

Lessons Learned – what do other cities, other actors and the EC have to consider?

C7: Lessons learned:

The lesson learned from the application of the MIRACLES measures, under the transportation point of view could be synthesized into a sentence: “Restrictiveness works!”. Of course this is just a slogan and it would be inaccurate to consider it strictly as an achievement. However, it is unquestionable that positive outcomes as an increase of modal shares towards walking and transit were stronger where constraints as access restriction are implemented or where charges as on-street parking could be applied. However, measures as restricting traffic or road pricing even though clearly targeted to reduce private cars widespread use; must be considered in synergy with the incentives to use transit (the increase of collective taxis or the conversion of the transit fleet to clean vehicles), as well as with actions aimed at raising people’s awareness towards more sustainable mobility patterns; “forbiddance” was just a macro-cause of some positive outcomes but the phenomenon must be construed taking also into account results coming from the society and the environmental indicators analyses. Then, if all these results are put together, it came out that restrictions to use private cars can be assessed by citizens as less positive than incentives to increase transit, even if environmental benefits are evident from the do-something simulations and confirmed by ex post surveys. The reason could be interpreted that car culture habits remain still strong. Possible open questions, hence will concern the way in which the use of private cars can be discouraged at a political level: whether it must be based on restrictiveness, as currently applied, or it has rather to become a sort of support to more popular incentives to attract passengers to transit. The challenge will be based, then, on the creation of more attentive behaviour among the private cars drivers, as results of an overall increase of sustainability.

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