Executive summary

This measure comprises the implementation of an updated GPS/GPRS Operation Support System in all the Municipal Public Transportation Services of Coimbra (SMTUC) bus fleet and the installation of new generation real time passenger information panels in order to improve PT commercial speed and guarantee more accuracy in the real time information.

The innovative aspects of this measure are very relevant because they have a positive impact in the quality and accessibility of PT. More precisely, the use of GPRS data transmission system allows for improving the quality and efficiency in the real time operational management of the urban PT network and opens up the possibility of implementing in the future an integrated management system of the city traffic lights (giving priority to the PT fleet). Also it permits an optimisation electronic real-time information panels at bus stops (that are accessible to all users and that are supplied with renewable energy) –

The demonstration of the measure within the CIVITAS MODERN period showed that this measure is feasible at a relatively low cost in comparison to those of PT operation.

The demonstration of the measure achieved positive impacts over (passenger numbers and therefore in) the average operating revenues, operating costs, the percentage of trips lost due to traffic problems, the average network speed, and the awareness level of the PT users in a relatively short period of time.

The results obtained in relation to the Cost Benefits Analysis (CBA) suggest that the measure is both effective and efficient in achieving positive results in terms of cumulated costs not only in lifetime of the measure (11,7M € in 10 years) but since the year of its implementation. Also, more than half of the investment will be covered in 10 years only with the decrease of the costs.

The implementation of the measure shows that:

- The upgrade of the Operation Support System to GPRS technology is a cost-effective way to improve the quality of the PT operation management and of the information to the public (including travel planning real-time information on mobile phones) in transport companies that possess more obsolete technologies, namely with investment requirements that are substantially inferior to the costs of acquiring a new system.
- The installation of e-panels in the lobbies and waiting rooms of hospitals with the real time information about the bus arrivals at the nearby bus stops is a good option to improve the information given to the public considering the high visibility and attendance of such places and the reduced costs of the these e-panels in comparison to those usually applied at bus stops.
- Stakeholders should be involved in the specification and launching of the products.
- To preserve the credibility of the information systems among the public it is indispensable to maintain a rigorous and frequent control of the information supplied to users. Accompanying the installation process and monitoring the early stages of operational management of the GPRS / GPS Operation Support System was very important for detecting and characterising the diverse problems that came up and to find rapid solutions for them.

A Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

- To reduce city traffic levels
- To increase the quality of the urban Public Transportation (PT)

(B) Strategic level:

- To guarantee an accurate real time management of the urban PT network, with special attention to the reliability and image of the service, including the information to the public.

(C) Measure level:

(1) To implement an updated GPS/GPRS Operation Support System[1], with new equipment on board 125 buses and to renew 12 existing real time passenger information panels in order to allow more accurate real time information – reducing the information update gap to less than 1 minute - and improve commercial speed – increasing it by 0,5% in the SMTUC[2] PT network.

(2) To install 6 new generation real time passenger information panels

(3) To develop 1 mobile phone application for passenger information (PT timetable consultation)

(4) The improved real time transport network management also could allow to surpass the 99,5% supply of trips (i.e., the number of trips made in comparison to the ones programmed).

A2 Description

The city of Coimbra is serviced by SMTUC, the public transport operator which covers the majority of the area of the municipality of Coimbra

In order to guarantee the operational management of its PT network, SMTUC has an Automatic Vehicle Management (AMV) system at its disposal. This system is based on GPS technology for establishing SMTUC fleet location and routing. SMTUC possessed an analogical communication and data transfer system from the year 2000 up to the beginning of the CIVITAS MODERN project. However, this system became obsolete and began to reveal some problem regarding its feasibility.

[1] Automatic Vehicle Management (AVM) System

[2] Municipal PT operator that cover all the urban area of Coimbra City and the major part of Coimbra Municipality

To improve information quality and the management of the urban public transport fleet, SMTUC was to transfer to a GPS/GPRS technology system.

The updating for the GPS/GPRS – Operation Support System occurred in 2008, just before the start of the CIVITAS MODERN Project and consisted mainly in the following:

- Purchase of 125 new single board computers and command consoles for SMTUC public transport fleet, which could support the GPS/GPRS technology and offer more functionalities and lessen maintenance costs.
- Installation of the new software in the control centre and in the 12 existing real time public information e-panels at bus stops.

The system covers the entire SMTUC PT network, i.e., the entire urban area of the city of Coimbra and the major part of the Municipality..

This updated AVM system has been used in the measure to allow improved real time information for the PT network management and for the infomobility tools. The data actualization in the control centre and in the other devices, namely the e-panels, became more frequent, allowing for more accurate real time information.

Taking advantage of the enhanced system, to increase the information provided to the Coimbra inhabitants and visitors, in the scope of the CIVITAS MODERN project a public information system for mobile phones was developed and 6 new generation electronic panels with real time information about bus schedule (1 for bus stops and 5 for interiors) were designed and installed with the following characteristics:

- The mobile phone application “SMTUC Mobile” provides the Urban public transport time tables on mobile phones, with the possibility of filtering travel period, lines, bus stops, etc. (allowing the automatic information to the user about the travel time more suitable) free of charge.

- The electronic panel at bus stops is powered by solar energy and is equipped with a second display closer to the users that provides the same information as the main display, but which is more adequate for the visually impaired..

- The e-panel for interiors were placed in hospital lobbies to provide real time information about PT bus trips in the nearest bus stops. This activity supported the mobility actions of the CIVITAS MODERN measure 04.05 – Mobility Management Actions.

The GPS/GPRS – Operation Support System is managed at the SMTUC control centre that monitors the public transport network, including the real time information provided to the users (the centre functions every day from 5:30 a.m. to 1:30 a.m. with, at least, 3 employees/day).

The control centre is also responsible for the supply of data for other systems, such as the new e-ticketing system (passenger entry is geo-referenced, lines and bus stops and the PT schedule are coded), the “trip planner RUMOS” (PT routes, bus stops and schedule) and the Geographic Information System of SMTUC (passenger entry, PT routes, bus stops and schedules are geo-referenced). On the other hand the e-ticketing console in the buses also command the GPS/GPRS – Operation Support System, to avoid duplication of operations for the bus drivers and the redundancy of equipment(which is very useful in case of failures).

A feasibility study was also carried out in order to assess the technical, economical and quality impact of implementing an integrated management system of city traffic lights on the public transport network (with priority for public transport fleet at the cross roads). Two solutions were identified and analysed:

- At each individual cross road the priority is stipulated only by the approach of each individual bus, which sets-off the beginning of the green cycle.
- The GPS/GPRS – Operation Support System automatically manages the priority system.

The second solution was identified as being better and several tests with the GPS/GPRS – Operation Support System and the traffic lights control system were carried out in order to assess the compatibility of the 2 systems and the possibility of implementing it in the in a short time period (despite that during CIVITAS only the technical study was foreseen).

B Measure implementation

B1 Innovative aspects

The innovative aspects of the measure were:

- **Innovative aspect 1** – Use of new technology/ITS
    - Use of GPRS data transmission system that allows for more reliable high-speed information transmission, with better quality in the real time updating of all devices on all usable levels.
    - Electronic panels at bus stops supplied by solar energy and equipped with a second display closer to the users that provides the same information of the main display (aiding the visually impaired), , and allows for the loading of the transport e-tickets and the consultation of its balance.
    - Opportunity of using the GPS/GPRS – Operation Support System to provide information for the integrated management of the city traffic lights allowing for the priority to PT fleet at the cross roads in the future (this system is not yet used in Portugal).
- **Innovative aspect 2** – Targeting specific user groups
    - The implementation of applications, such as "SMTUC Mobile" could increment the use of PT by more a demanding public which is more receptive to new technologies, namely young people.
    - The above mentioned e-panels, allows for the visually impaired and other segments of the population with physical limitations (such as the elderly) to have access to the information about the PT system.

B2 Research and Technology Development

The major part of the research and technology development activities in this measure occurred before the start of the CIVITAS MODERN project and was linked to the specifications and development of new software for the GPS – Operation Support System which would replace the analogical (trunking) data transmission technology by GPRS technology. On the other hand, the development of the new e-panels (for bus stops and for interiors) and of the "SMTUC Mobile" application took place during the project, as well as all the tasks linked to the feasibility study on the traffic lights priority for the TP fleet.

These activities are explained below:

Starting in 1999, the urban public transport services of the city of Coimbra (SMTUC) purchased and installed the first GPS - Operation Support System - which was the basis for the system upgrade conducted in 2008.

With this initial system the following elements were installed:

- Infrastructure for radio communications with a Station Base running in Trunking System (System architecture in Fig. B2.1.1).
- Network Control Centre, that consists of a server, a supervision workstation and two posts to control the entire SMTUC PT network.
- On-board equipment, including a radio for voice communication and data, a computer connected to the radio, an antenna for communications, and a GPS receptor, various sensors of bus surveillance, and audio equipment for the automatic passenger information audio system.
- Real time information e-panels for passengers at 12 bus stops.

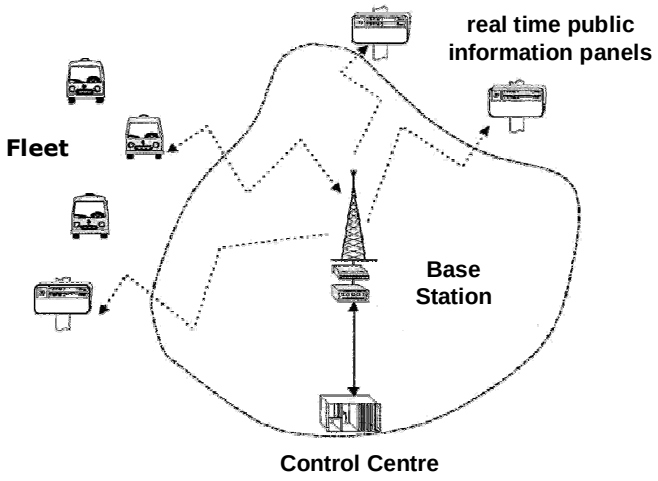


Figure B2.1.1 – System Architecture

The initial system already contemplated the following features:

- Operational management of the vehicles in real time, including the reliability of timetables and the status of the buses (on time, delayed, ahead of time) ;
- Knowledge of real-time location of vehicles;
- Establishment of voice communications between the Control Centre and the vehicles;
- Real time automatic information to passengers at stops on the conditions of supply of transport with time of arrival of the next buses;
- Automatic sound information for passengers in the vehicles indicating the next stop and the notice of the approaching stop;
- Analysis of the performance of the Network;
- Real-time transmission of irregularities in the operation of vehicles and traffic in general;

The second phase began in 2007. This phase comprehended the research and specification work for identifying the required improvements needed for running the initial system with greater accuracy.

The main problem, which was urgently addressed, was that the communications system, via Trunking technology, only provided information of the status of vehicles at intervals of about 2

minutes or more. This raised questions about the accuracy of the real time information at the bus stops e-panels and the real time data for the management of the public transport network.

The fact that the e-panels only allowed information for bus 4 lines of the SMTUC PT network at once (one for each row of the display designed for the purpose) hindered the possibility of a alternation among the various lines that serve each stop. This limitation affected the quantity and quality of the information provided, especially in the City's central stops supplied by a large number of PT lines.

Accordingly the upgrade of the GPS – Operation Support System sought to achieve the following results:

- Improve the efficiency and precision of the real time data transmission / fleet management system, namely allowing for the transmission of a greater quantity of data, with a greater transmission frequency, and a reduction in the system's failures;
- Replace the existing equipment for more modern equipment with reduced maintenance;
- Improve the production of real-time information for the general public and information for system planning and management;
- Improve the voice communication with the buses.

Therefore, a migration to data transmission system based on GPRS technology was carried out and the main modifications to the hardware were linked to the communication system. The SMTUC Base Station's analogical antennas were abandoned and communications were guaranteed through the use of an operator.

With regards to the Control Centre, the modifications centred essentially in changing the software and the communication equipment – GPRS for data transmission and GSM for voice communication

The main modifications resulted in the installation of new on-board computers on the buses. These new devices have touch screen technology which gives drivers' greater ease in using the system, as well as better quality in the information available. The new equipment also has new software and are split in 2 parts: The on-board concentrator that has the capacity to process information autonomously and concentrates the interactions with the rest of the bus's equipment (ignition, odometer, and assorted telemetric); The on-board computer that has a touch screen and houses all the relevant data (routes, timetables, etc.), processes data, and interfaces with the driver..

Also, new GPRS data transmission equipment and software were placed in the existing 12 e-panels

The software main modifications are:

The previous system used an analogical trunking radio network for data and voice communications. This technology did not permit the simultaneous transmission of voice and data. In addition, the minimum period for relaying position information was never under one and a half minutes (usually it was higher);

The substitution of data communication through GPRS technology has allowed for greater efficiency and data transfer capacity.

Position information communication is now done in one minute intervals. Also, the commands effectuated by the drivers are delivered immediately (contrary to the previous system)

The adaptation of the software to the new data communication system was carried out on the system's server, the buses, and the e-panels;

Voice communication is now established through GSM (cell phones were distributed to all SMTUC bus drivers). Therefore, it does not interfere with data communication and has substantially improved the overall quality of communications. Also, communication with the driver is now possible even when he is outside the bus;

The shorter and improved bus position information relay period makes the system more efficient in all aspects – real time information for the public, in the e-panels, and for the operators at the Operation Support System;

Inside the bus the driver now possess information about the journeys, such as start and finish points, bus schedule, eventual route delay time, and indication of the next stop;

In the previous system, timetables were introduced into the on-board computer through a memory card which the driver had to retrieve daily at the control centre. This process had numerous inconveniences: card damage or malfunctions were frequent; cards were many times lost or left on the bus; in routes with high frequency rates two cards were required due to the card memory limits.

In the current system all the information is in the on-board computer where it is updated using a pen-drive in a first phase and now automatically by WiFi (taking advantage of the integration with the new e-ticketing system – CIVITAS MODERN measure 02.05). The integration with the new system also allows the driver to use only one of the consoles for introducing data for both systems (the e-ticketing system module is used by default).

The 2nd generation of e-panels was designed with the participation of SMTUC technicians. As specified, they are supplied by solar energy and have a secondary module that allows for the consultation of the e-tickets by users and also have a screen with the same real time information that is displayed in the main screen – for visually impaired and elderly citizens – as well as sound system for the blind.

The accuracy of the information provided by the system upgrade also allowed for an improvement of the information channels and processes. In other words the upgrade fostered better tools for the management and integration with other systems, as well as allowed for the use of this information to launch a new system supplied by this data e.g., Geographic Information System, the mobile phone application "SMTUC Mobile", the "RUMOS" trip planner and the new e-ticketing system.

A mobile phone application in which the data base is updated with the data provided by the GPS / GPRS Operation Support System was also developed (Initially it was foreseen only a feasibility study for a SMS application). The application – "SMTUC Mobile" – consists of the following:

The application could be downloaded from the SMTUC webpage and run in Java systems for mobile phones, so a "Smartphone" is not necessary for this application (an Android application has been released and is in tests).

The users only need to download the application to their mobile phones and don't have additional costs to access the bus timetables.

The application suggests the best trip time for the PT line chosen by the user, according the actual hour or the period chosen.

A feasibility study was also carried out in order to assess the technical, economical and quality impact of implementing an integrated management system of city traffic lights on the public transport network (with priority for public transport fleet at the cross roads). 2 technical solutions that were compared:

- At each cross road the priority is stipulated only by the approach of each bus. In this case it is the arrival of a bus that commands the beginning of the green cycle, without intervention of the control centre of the GPS/GPRS – Operation Support System. This solution is cheaper but less efficient because all the buses have the same treatment and buses with delays don't have priority. Also it increases the risk of a negative impact in the city's global traffic;
- The GPS/GPRS – Operation Support System is responsible for the management of the priority system and the start of a green cycle for buses only begins for buses with delays that are approaching a cross road. This system is more expensive, because it implies costs in software development for the control centre of the GPS/GPRS – Operation Support System. However it allows for more quality in the PT network and for a decrease in the risk of the negative impact in the overall traffic.

B3 Situation before CIVITAS

Coimbra Municipality has had a strong concern about the citizens' information on mobility issues. Inclusively, to deal with these concerns it has installed some multimedia offices in some strategic city spots.

In the case of SMTUC, real time public information panels on the bus trips were installed in some of its bus stops..

All the SMTUC information came from a GPS – Operation Support System in which communications were based in a radio system. The system allowed also for the management of the SMTUC PT network from a control centre, giving real time information about the fleet localization and its delays or advances in comparison to the foreseen buses schedules, as well as the communication with the drivers trough data or voice messages, and a real time sound system on board buses providing the information about the next bus stop.

This analogical communication system had some limitations in the quantity, frequency and precision of the data transmitted to the PT fleet and the first generation of electronic panels..

The main problems of the analogical system are the communication frequency (the excessive time needed to update the data in each bus or e-panels), the lower quantity of data provided in each data transfer, and the lack of reliability of the single computers on board the buses. Mainly, the first and last issue cause difficulties in the management of the PT network and less quality in the real time information provided for the e-panels and on-board buses (sound messages about next bus stop), while the lower quantity of data provided hindered the development of new functionalities.

Also the lack of reliability and precision contributed to the achievement of contrary results compared to those expected. The system did not satisfy all the users expectations.

Accordingly, there was the need for a more accurate and quicker system and with improved data communication frequency. For these reasons, in the scope of the CIVITAS MODERN project it was be decided to upgrade the GPS – Operation Support System by migrating to GPRS communication and the development of new software. That was the only way to achieve a satisfactory level in the real time information quality at the bus stops. In addition, there were gains in the global and integrated management of the transport network functioning that can improve even more with the desired extension of this to the integrated management of the city traffic lights allowing the priority to PT fleet at the cross roads.

With the improvements described above, particularly the gains in the real time operational management of the PT network, during CIVITAS the accuracy and reliability of the PT schedules, was increased, raising the PT commercial speed by 2% (more then the 0,5% initially expected).

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Model's conception and definition of technical specifications for the Operation Support System upgrade *(October 2008-February 2009) – The major part of the specifications and development were made before CIVTAS start-up and were used by the Project. This initial work consisted of the development of new GPS / GPRS – Operation Support System software in Coimbra to replace the previous analogical radio system, so that it can support the data communication technology by GPS/GPRS and new functionalities.*

During CIVITAS the design of the new e-panels that could be feed by solar energy and with a module in the base of the mast with a 2nd display for real time information and reading and loading of the e-tickets was carried out..

A document concerning the "Report on design and implementation of the System" was also delivered.

Stage 2: Purchase and installation of the GPS / GPRS – Operation Support System *(October 2008) – The lack of feasibility and precision of the existing analogical system and the difficulty in finding suppliers for the damaged equipment of the existing system forced the need to hasten the purchase process and avoiding the start of the CIVITAS Plus project (which was postponed). The purchase and installation process were concluded with success before CIVITAS start-up and the system was used by the project. This phase included mainly the installation of the 125 new single board computers (that support the GPS/GPRS technology) for the totality of the SMTUC public transport fleet, the installation of the new software in the control centre and in the 12 existing real time public information e-panels at bus stops and the substitution of the voice communication equipment. The data actualization in the control centre and in the other devices, namely the e-panels, became more frequent, allowing for more accurate real time information.*

The on-board equipment installed in the entire SMTUC fleet has the following characteristics:

On-board concentrator

The equipment has the capacity to process information autonomously and concentrates the interactions with the rest of the bus's equipment (ignition, odometer, and assorted telemetric). It also posses a GPS (Sirfill) and a GPRS modem. This equipment interacts with the on-board computer and has the following characteristics:

On board computer

The computer has a touch screen and houses all the relevant data (routes, timetables, etc.), processes data, and interfaces with the driver. It has the following characteristics:

Due to voice communications having passed to GSM technology, cell phones were distributed to all 284 SMTUC bus drivers.

The entire SMTUC PT network was covered with the new GPS/GPRS Operation Support System (82 bus-lines and a network extension of 556 Km)

Stage 3: Training of the System users *(October 2008 – February 2010) – Before the beginning of the CIVITAS MODERN project the initial training concerning the operations with the equipment on board buses for the drivers and their trainers and training for the control centre personnel on the system management was carried out (315 participants during 472 hours). This phase also comprised the training of maintenance personnel trainers (5 participants during 70 hours).*

In 2010 new training actions for the drivers about the 2nd model of mobile phones for the voice communications and to the control centre users about new functionalities, such as the "SMTUC Mobile" System took place (327 participants during 344 hours).

Stage 4: Operational management and monitoring of the updated GPS / GPRS – Operation Support System *(October 2008 – October 2012) – The start-up of the updated system was in March 2008, before CIVITAS beginning. During CIVITAS this stage consisted of the monitoring of the public transport network, functioning every day from 5:30 a.m. to 1:30 a.m. with at least on staff member in permanence, reinforced by more personnel, mainly at rush hours. Some of the activities are:*

- *Monitoring the real time trip of the buses to avoid gaps in comparison to the schedule, trying to ensure the reliability and quality of the service provided.*
- *Monitoring the real time information displayed on electronic panels at bus stops to avoid inconsistencies with reality.*
- *Establish communications with the bus drivers when necessary.*
- *Real time security survey of PT users and bus drivers.*
- *Real time maintenance survey of buses and other equipment, like panels at bus stops and audio real time user information in the interior of the buses.*
- *Delivery of the information received and stored on the server of the system, including the data needed for other systems, such as the "trip planner RUMOS" and the "SMTUC Mobile".*
- *Data collection for evaluation purposes.*

The control centre is also responsible supplying of data for other systems, such as the new e-ticketing system (passenger entry is geo-referenced, lines and bus stops and the PT schedule are coded), the "trip planner RUMOS" (PT routes, bus stops and schedule) and the Geographic Information System of SMTUC (passenger entry geo-referencing, PT routes, bus stops and schedule). On the other hand the e-ticketing console on the buses also command the GPS/GPRS – Operation Support System, in order to avoid the duplication of operations for bus drivers and to allow redundancy of equipment, which is very useful in case of failures.

Stage 5: Development launching of the "SMTUC Mobile" System *(October 2008 – September 2009) – Development of an application (SMTUC Mobile) to be allocated in PT WebPages, that supplies PT timetables on mobile phones when uploaded to this equipment (fig B4.1). The application suggests the best trip time for the PT line chosen by the user, according the actual hour or the period chosen. Between April and September 2009 the tests phases were carried out and there was the improvement of the different software versions until the successful final version was delivered.*

The public transport service of the Portuguese City of Braga has also implemented this system, taking into consideration the great success of this application in Coimbra and its advantages, namely to be free for users.

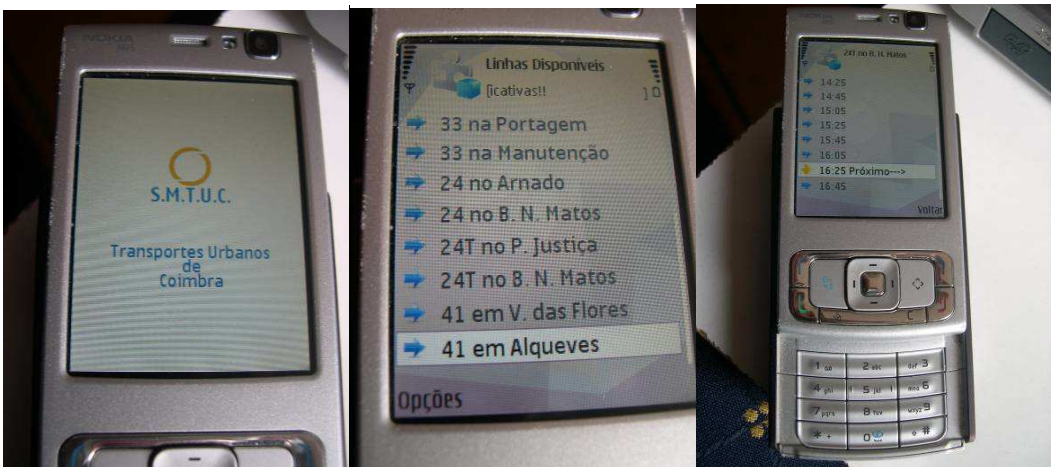


Figure B4.1 – Overview of the "SMTUC Mobile" application

Stage 6: Technical study for preferential traffic light regulation for PT *(September 2009 – January 2010)* –A feasibility study was also carried out in order to assess the technical, economical and quality impact of implementing an integrated management system of city traffic lights on the public transport network (with priority for public transport fleet at the cross roads).. *The study took in consideration, namely, the following:*

- *Survey of Urban PT routes and road intersections to chose priority sites for implementation of the system;*
- *Survey of traffic light controls to analyse which control device models could receive the system;*

- *Contacts with suppliers to choose the best solutions to apply;*
- *Study performed to analyze various solutions for the conflict between regular traffic and public transport in traffic light controlled intersections;*
- *Traffic counts at the designated axis, for an established period of time, allowing for an estimation of the losses and concentration of volume of public transport that needs to proceed with priority passage in a specific trip and during the period of highest traffic intensity;*
- *Study of the traffic lanes with the most congestion during the period of highest traffic intensity (rush hour);*

Two solutions were identified, studied and estimated costs for each one:

- *In each cross road the priority is stipulated only by the approach of each individual bus, which initiates the beginning of the green cycle;*
- *The GPS/GPRS – Operation Support System manages the priority system and only initiates the start of a green cycle for buses that approach a cross road with a delay in its schedule.*

A report that schematizes the two identified solutions, highlighting the advantages and disadvantages of each one, was released. The report highlights that the second solution is better for enhancing the quality of the PT service.

The future implementation of this system namely aims to increase the Average PT Network speed.

Despite that during CIVITAS only the technical study for preferential traffic light regulation for PT was foreseen, the Municipality and SMTUC conducted several tests with the GPS/GPRS – Operation Support System and the traffic lights control system in order to evaluate the possibility of implementing the preferential traffic light regulation in a short period.

The tests were confined to the city centre, which is the area of the city that could receive this system in the future (fig B4.2).

Figure B4.2 – Centre City areas appointed for the implementation of the preferential traffic light regulation for PT

Stage 7: Purchase and installation of the 2nd generation e-panel that allows real time public information for the passengers *(March 2009 – October 2012) –The first new model of the 2nd generation e-panel, which allows for real time public information at bus stops was installed (fig. B4.3). . The tests have been successful and it was decided to purchase more e-panels.*

Real time information panel at bus stops powered by solar energy (left) and detail of the secondary module with second information screen and "contact less" reader (right)

Main screen of the panel with real time information about buses arrivals time

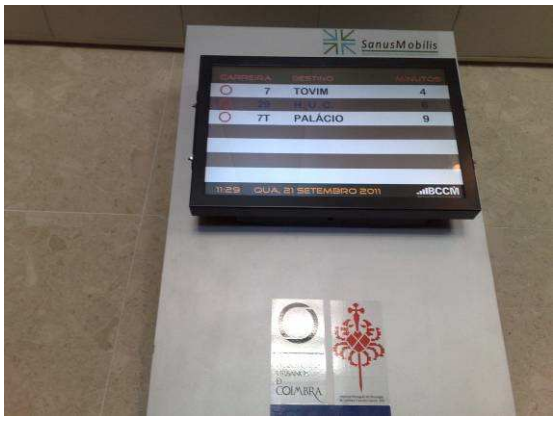
Figure B4.1 – Overview of the real time information panel

In the last trimester of 2011 SMTUC purchased another 5 e-panels with real time information, that are similar to the e-panels installed at bus stops, but are designed for interiors (Fig.B4.4).

The first e-panel for interiors has been installed at the lobby of the IPOC hospital on the 22nd September 2011, integrated in the mobility actions of CIVITAS measure 04.05.

This kind of e-panels allows users to be comfortable in the hospital lobby while they wait for the arrival of the bus. The possibility to rest in the lobby until the last moment is very important taking in attention that the majority of these users have problems of accessibility (patients, elderly, handicapped, …)

E-panel in the lobby of the IPOC hospital.



The e-panel gives real time information about bus arrivals at the bus stops near the hospital

Figure B4.2 – Overview of the real time information panel in the IPOC Hospital

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure no. 02.05** –At a functional aspect the e-panels of the GPS/GPSR – Operation Support System will have capabilities linked to this system (module that display the contents of e-tickets and could load e-cards in the future);

- **Measure no. 04.02** – At a functional aspect the static data provided by the GPS/GPSR – Operation Support System will have capabilities linked to the "RUMOS trip planer", integrated in this measure no. 04.02;

- **Measure no. 04.05** – At a functional aspect the e-panels of the GPS/GPSR – Operation Support System was integrated in the actions foreseen for the mobility plans for the hospitals involved in this measure no. 04.05.

C Evaluation – methodology and results

C1 Measurement methodology

C1.1 Impacts and Indicators

Table C1.1: Indicators.

No.	Impact	Indicator	Data used	Comments
1	Operating Revenues	Average Operating Revenues	Total income generated from fares and tickets; total vehicle-km	Operating revenues are provided by SMTUC
2	Operating Costs	Average Operating Costs	Total operating costs incurred by the management and information systems; total vehicle-km	Operating costs are provided by SMTUC
3	Costs	Capital Costs	Total capital costs expended in setting up the measure	Capital costs are provided by SMTUC
4	Service Reliability	Percentage of lost trips due to traffic problems	Total number of performed trips; Total number of scheduled trips	% lost tripe are provided by SMTUC
5	Vehicle Speed	Average PT Network Speed	Total PT vehicle-km; Total vehicle-h	PT network speed are provided by SMTUC
6	Awareness	Awareness level – users	Total number of respondents with knowledge of the measure; Total number of respondents	Awareness level are by the SMTUC satisfaction survey

Detailed description of the indicator methodologies:

- **Indicator 1** (*Average Operating Revenues*) – Ratio of total income generated from fares and tickets, divided by the total vehicle-km per year (€/vehicle-km).

  A = B / C

  where: A = Average operational revenue for the SMTUC PT service (€/vehicle-km)

  B = Total operational revenue coming from tickets/fares sales (€)

  C = Total vehicle-km

  All data is related to the overall SMTUC services and fleet. Results from vehicle-kilometres coming from the subtraction of non performed trips data to the scheduled ones. The source is the Excel file where the trips are recorded every day. The data reliability is maximised due to an accurate data collection among SMTUC records on performed and scheduled trips, which in turn are recorded following reliable procedures: each driver records the corresponding performed/non performed trips; the extension of each trip is known; the number of performed trips recorded by the drivers is validated by the GPS/GPRS Operation Support System.

- **Indicator 2** (*Average Operating Costs*) – Ratio of total operating costs incurred by the service divided by the total vehicle-km per year (€/vehicle-km).

  A = B / C

  where: A = Average operational costs for the service (€/vehicle-km)

  B = Total operational costs of the service, including Personnel Costs, Fuel Costs, Maintenance Costs and Other Operational Costs related to the SMTUC PT service (€)

  C = Total vehicle-km

  All data are related to the overall SMTUC services and fleet. Results from vehicle-kilometres coming from the subtraction of non performed trips data to the scheduled ones. The source is the Excel file where the trips are recorded every day. The data reliability is maximised due to an accurate data collection among SMTUC records on performed and scheduled trips, which in turn are recorded following reliable procedures: each driver records the corresponding performed/non performed trips; the extension of each trip is known; the number of performed trips recorded by the drivers is validated by the GPS/GPRS Operation Support System.

- **Indicator 3** (*Capital Costs*) – Total capital costs expended in setting up the measure (€).

  Expenditures with the purchase and installation of the necessary equipment (single board computers for buses and information panels, new GPS receptors, real time information panels for bus stops), software for the management and information systems and with the development and research for new GPRS software for control centre, single board computers and information panels (€)

  All data is related to the overall SMTUC management and information systems and fleet. The data reliability is maximised due to an objective data collection.

- **Indicator 4** (*Percentage of lost trips due to traffic problems*) – Percentage of trips lost due to traffic problems by the SMTUC fleet during regular operation in comparison to the scheduled trips (%).

  A = B / C × 100

  where: A = Percentage of lost trips (%)

  B = Total number of lost trips due to traffic problems

  C = Total number of scheduled trips

  All data is related to the overall SMTUC regular operation. Results from lost trips and their respective loss motive are registered monthly. The source is the Excel file where the trips are recorded every day by the SMTUC operator. The data reliability is maximised due to an accurate data collection among SMTUC records on performed and scheduled trips, which in turn are recorded following reliable procedures: each driver records the corresponding performed/non performed trips; the extension of each trip is known; the number of performed trips recorded by the drivers is validated by the GPS/GPRS Operation Support System.

- **Indicator 5** (*Average PT Network Speed*) – Ratio of total vehicle-km performed by the SMTUC fleet during regular operation divided by the total vehicle-h spent on performing the respective services (km/h)

  A = B / C

  where: A = Average PT Network Speed (km/h)

  B = Total vehicle-km

  C = Total vehicle-h

  All data is related to the overall SMTUC fleet. Results from vehicle-kilometres and vehicle-h coming from the subtraction of non performed trips data to the scheduled ones. The source is the Excel file where the trips are recorded everyday. The data reliability is maximised due to an accurate data collection among SMTUC records on performed and scheduled trips, which in turn are recorded following reliable procedure: each driver records the corresponding performed/non performed trips; the extension of each trip is known; the number of performed trips recorded by the drivers is validated by the GPS/GPRS Operation Support System.

- **Indicator 6** (*Awareness level*) – Percentage of the users with knowledge of the measure on account of provided information (%).

  A = B / C × 100

  where: A = Percentage of users with knowledge of the measure (%)

  B = Total number of respondents with knowledge of the measure

  C = Total number of respondents

  The Awareness level of the measure is measured during customer satisfaction surveys (for more details, see annex dedicated to the customer satisfaction survey) by introducing the following specific question relative to the knowledge of the respondent about the measure – Are you aware about the SMTUC timetable information service for mobile phones?

C1.2 Establishing a Baseline

The year 2007 is considered as the baseline, before the start of the "operational management and monitoring of the updated GPS / GPRS – Operation Support System" in March 2008.

The measure results are obtained from SMTUC records on indicators 1, 2, 3, 4 and 5 and from the customer satisfaction survey periodically carried out by SMTUC on indicator 6 – Awareness level of users.

Indicators 1, 2, 3, 4, and 5 (Operating Revenues, Operating Costs, Capital Costs, Percentage of lost trips due to traffic problems and Average Network Speed):

The transport company SMTUC provided information on both the costs of operating the SMTUC PT system and revenues coming from ticket sales to passengers in relation to the operation of SMTUC transport services. Similarly, it is provided information on the Average PT network speed, on the

Percentage of lost trips due to traffic problems in comparison to the scheduled trips along SMTUC regular operation and on capital costs in setting up the measure

The results of baseline for each indicator are:

Table 1 – Indicator n.1 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Revenues from tickets (€)	7.951.000,00
Total vehicle-km	5.887.000
Average operating revenues	1,35 €/vkm

Table 2 – Indicator n.2 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Total Operational Costs	14.171.776,57 €
Total vehicle-km	5.887.000 (vkm)
Average operating costs	2,41 €/vkm

Table 3 – Indicator n.3 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Investment in the purchase of the equipment	0,00 €
Total capital costs	0,00 €

Table 4 – Indicator n.4 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Total scheduled trips	382 232
Total trips lost due to traffic problems	1 062
Trips lost due to traffic problems	0,28 (%)

Table 5 – Indicator n.5 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Average Network Speed	16,67 (km/h)

Indicator 6 (Awareness):

This question was not applied before the launch of the "SMTUC Mobile" because it was considered that it is not rational to ask people if they know about something which has not yet happened. Thus, it is considered that before something exists awareness is zero because it is impossible to know it.

Table 6 – Indicator n.6 – ex-ante values

Indicators and respective parameters	Ex-Ante values
Awareness level – users	0 %

C1.3 Building the Business-as-Usual scenario

The CIVITAS MODERN accelerated the implementation of the GPS / GPRS – Operation Support System, the acquisition of more real time information e-panels, and the provision of the mobile phone application to users. Without CIVITAS these improvements would not have taken place within a 4 or 5 years (certainly not within the period of the project).

Without the implementation of the measure (business-as-usual scenario) no changes were likely to occur in any of the following indicators: 3 - Capital Costs, and , 6 - Awareness level – users. Therefore, the B-a-U scenario for these indicators equals to the respective Ex-Ante value.

The available historical data about the indicators 1 - Average Operating Revenues, 2 - Average Operating Costs, 4 - Percentage of lost trips due to traffic problems and 5 - Average Network Speed may help to detect trends for these indicators. The B-a-U scenario for these indicators is based on trend lines resulting from historical data about them over the last years of SMTUC operation.

Indicator 1 (Average Operating Revenues)

In order to determine the B-a-U scenario for this indicator, the available data about revenues from tickets has been used because the annual series data over the last years are available (in relation to vehicle-km it is considered that making extrapolations is non sense because it is a parameter that is controlled by the operator and not related to the measure). Thus, it is possible to extrapolate for the next few years.

Revenues from tickets are a product of the number of passengers and of the tariff requested to each passenger. In order to extrapolate on revenues from tickets the available data about the number of passengers has been used because the annual series data over the recent years is available (in relation to the tariff requested to each passenger it is considered that making extrapolations is non sense because it is a parameter that is controlled by the operator and not related to the measure).The following graph illustrates the real number of passengers of SMUTC until 2007 and the indexed projection from 2008 to 2012.

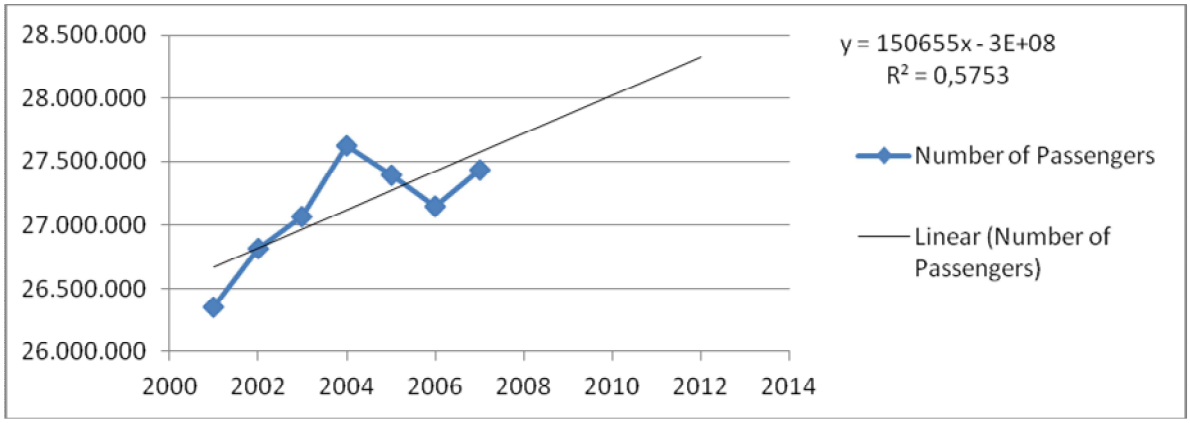


Figure 3 – Number of passagers until 2007 and linear projection for 2008-2012

However, with the financial crisis deeply affecting the Portuguese economy, extensive social changes occurred in Coimbra, with unforeseeable impacts over SMTUC PT demand.

The significant increase in the unemployment rate in Portugal (from 7,5% in the last trimester of 2008 to the actual rate over 15%), caused a decrease of the PT demand. However, the influence of the purchasing power in the demand for public transportation also needs to be known, in order to verify if this factor is enough to invert the tendency.

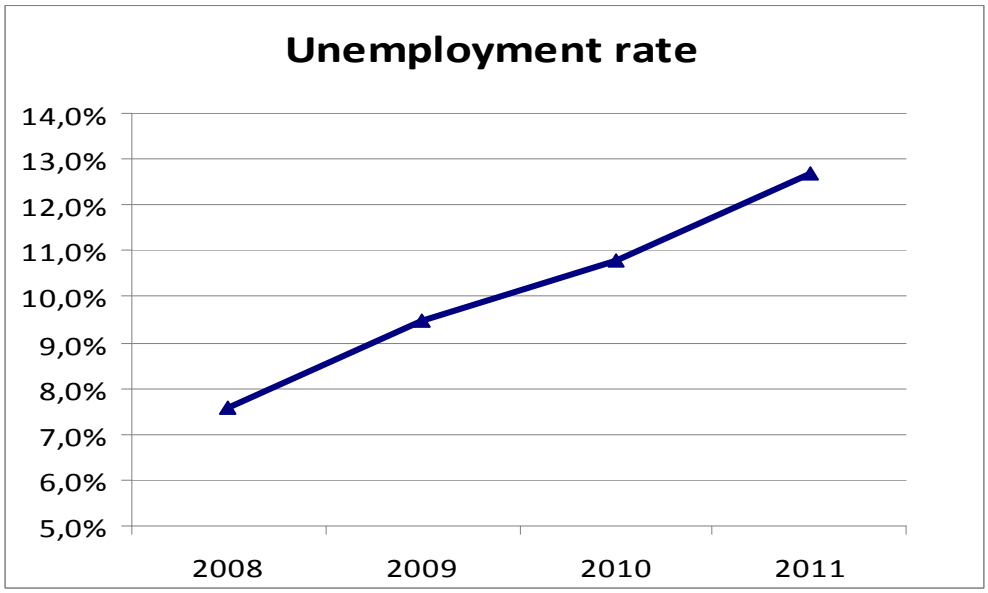


Figure 4A – Unemployment rate

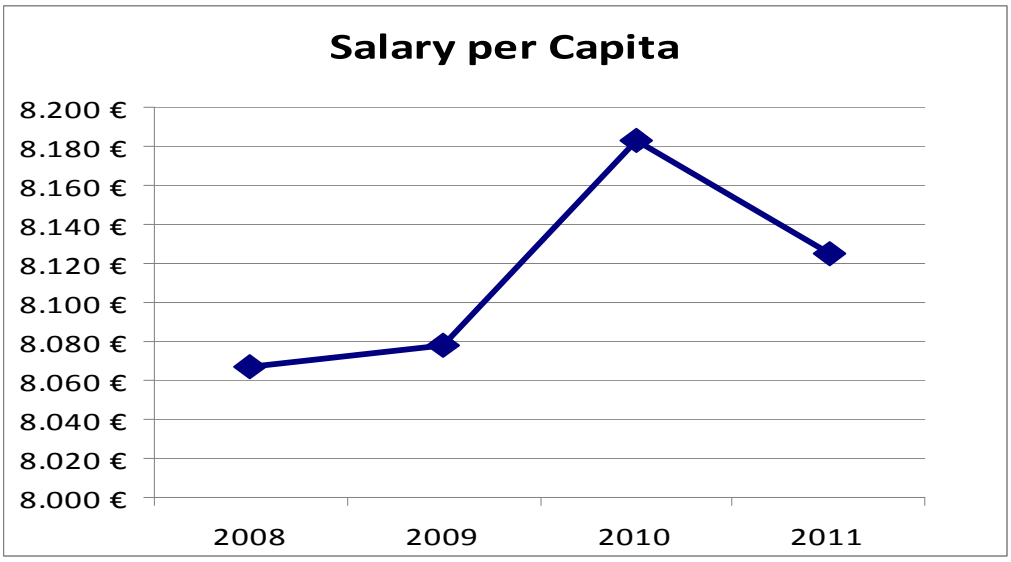


Figure 5B – Salary per capita

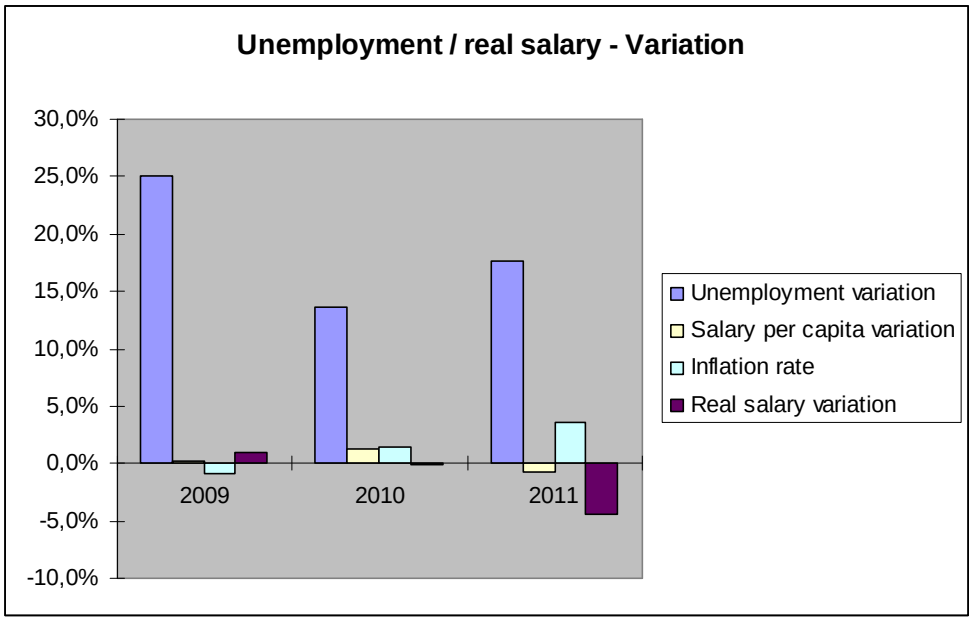


Figure 6C – Variation Unemployment rate/ real Salary

The unemployment rate has increased 25% in 2009 in comparison to 2008 and more than 13% in the other years (fig. 2A), while the real salary per capita has not witnessed comparable variations (maximum variation – decrease of 4,4% between 2010 and 2011 as shown in the fig.2B).

Accordingly, it seems that without CIVITAS the trend would be a drop in the SMTUC passengers due to the financial crisis and the fact that the influence of the augment in the unemployment rate was greater then the decrease in the purchasing power (fig.2C).

Thus, it has been considered that in this context extrapolation is no longer suitable and using available data from sites would be better to determine the evolution of the number of passengers.

The next graph shows the evolution of road based Public Transport passenger-km in Portugal (source: European Commission, EU transport in figures - Statistical Pocketbook, 2011).

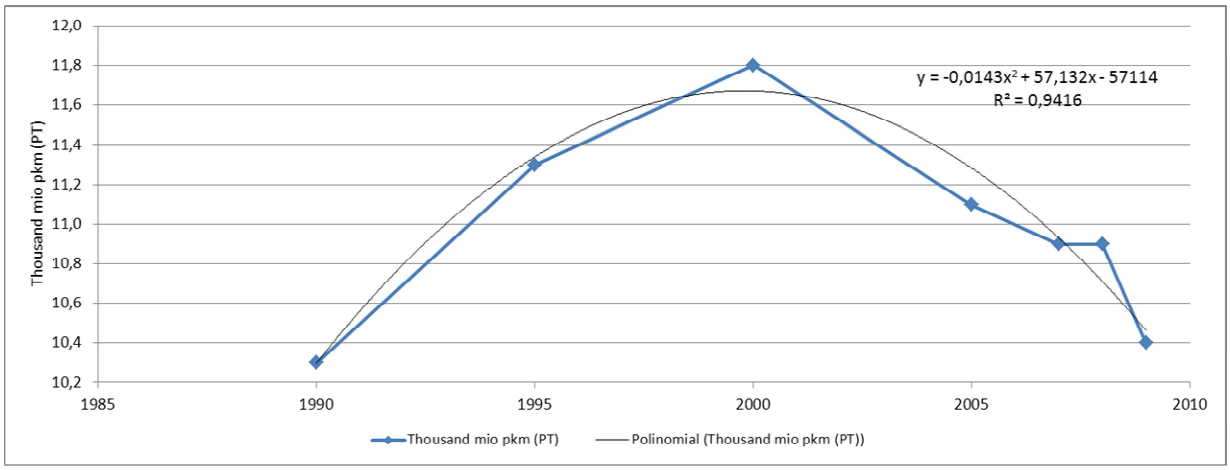


Figure 7 – Passanger kilometer forecasting

The above graph shows a 2 phase trend. During 1990-1999 an increase is identifiable in pkm and in 2000-2009 there was a decrease of Public Transport in Portugal.

The next graph shows the evolution of road based number of Public Transport passengers in Portugal from 2000-2003.(Source: GPERI-MOPTC (2009), Obras Públicas, Transportes e Comunicações - Alguns Números - 2000-2007, Transporte Rodoviário, Portugal (Source: INE)

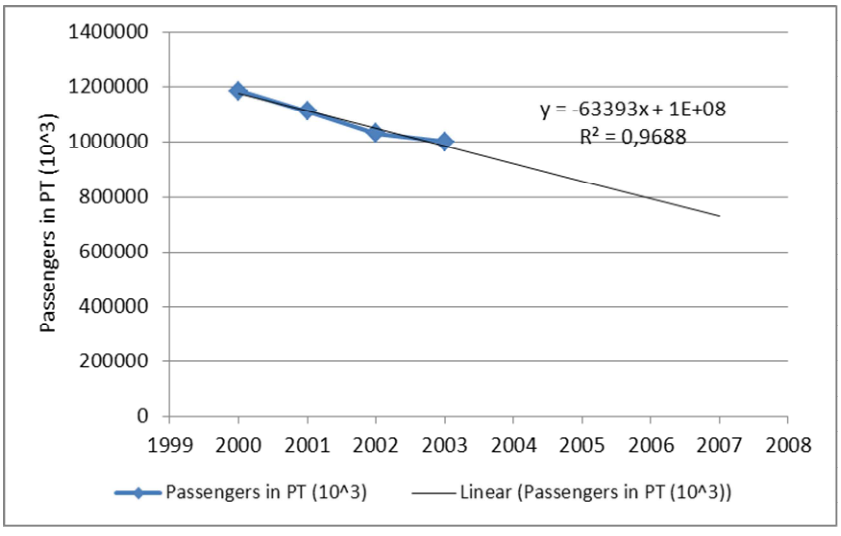
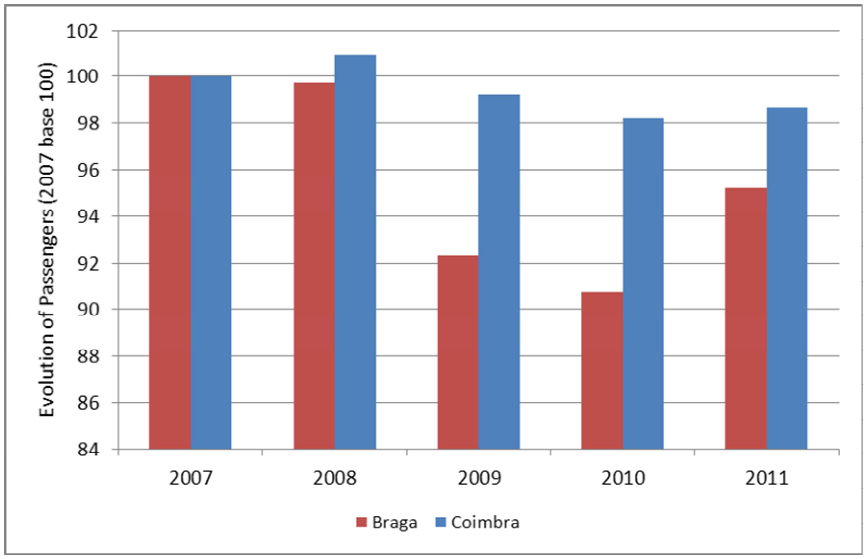


Figure 8 – Passanger in PT forecasting

The graph shows a decreasing trend in the number of passengers of PT in Portugal from 2000-2003, which confirms the general trend over the last decade of a general decrease in the use of PT in Portugal.

Considering that Braga is the Portuguese city most comparable to Coimbra in terms of population and transport supply, the available data relative to the road based urban PT operator of the city of Braga (TUB) has been chosen to extrapolate about the number of PT passengers in Coimbra.



The next graph shows a comparison between the evolution of passenger numbers in the SMTUC network with the evolution of passenger numbers in TUB network according to the data obtained:

Figure 9 – Evolution of passangers (2007 base)

The graph shows that SMTUC experienced a smaller reduction in the number of passengers than TUB. Hence, the assumption is that MODERN is the reason for the lower reduction and that in case of no MODERN in Coimbra the drop would have followed the drop in the number of passengers experienced by TUB.

The next graph shows the evolution of passengers in TUB network according to the data obtained (see annex):

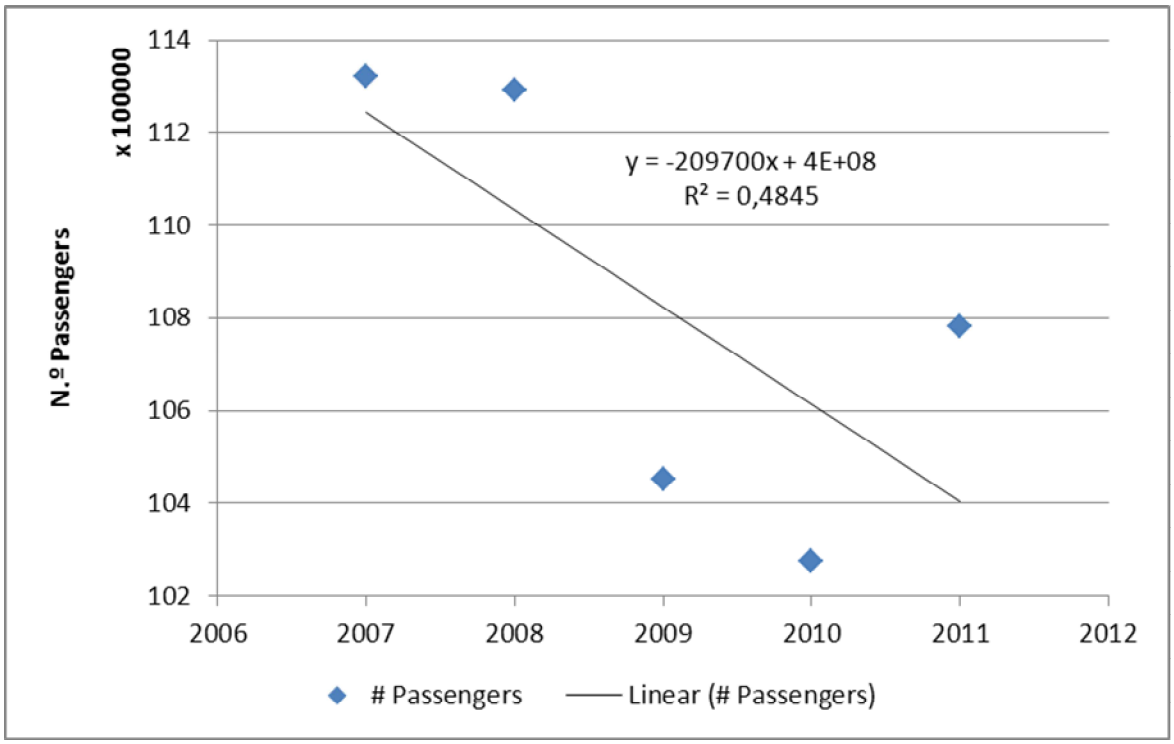


Figure 10 – Passengers in TUB network

By using the trend in the above graph, it was possible to extrapolate the number of passenger in Coimbra from the baseline (2007) until 2012 (BAU 2). The trend used for forecasting the evolution of passengers shows a low correlation coeficient (0,4845), i.e, a low degree of linear relationship between the two variables.

To analyse more pecisley, other types of trends (exponential, logarithmic, polynomial, …) were tested but at all of them show similar correlation coeficients. Due to this fact the linear trend was choosen as the the one that forecast the next period.

The following graph illustrates the passenger numbers in Coimbra from 2001-2007 (pax/year), the scenario resulting from the extrapolation of that data (BAU 1), and the scenario resulting from the use of the data concerning the Braga operator (TUB) to extrapolate about the number of passengers in the SMTUC network (BAU 2):

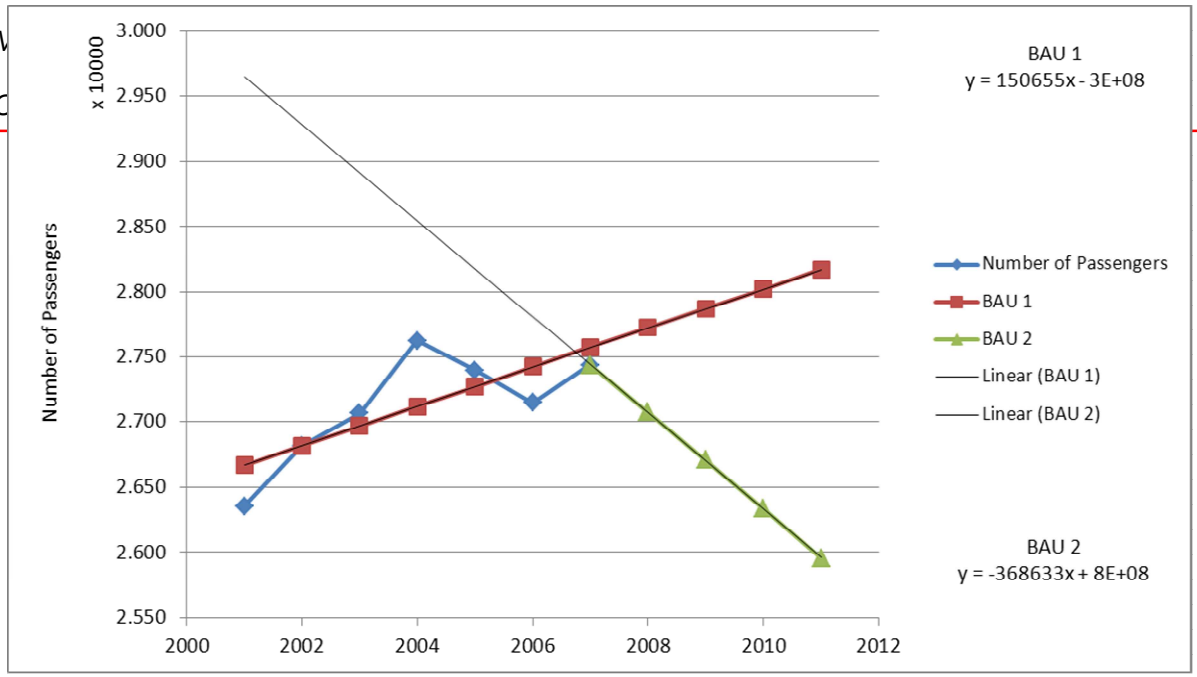


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Figure 11 – Passengers in SMTUC network forecasting

The next graph shows the evolution of the tariff requested to each passenger from 2001-2011.

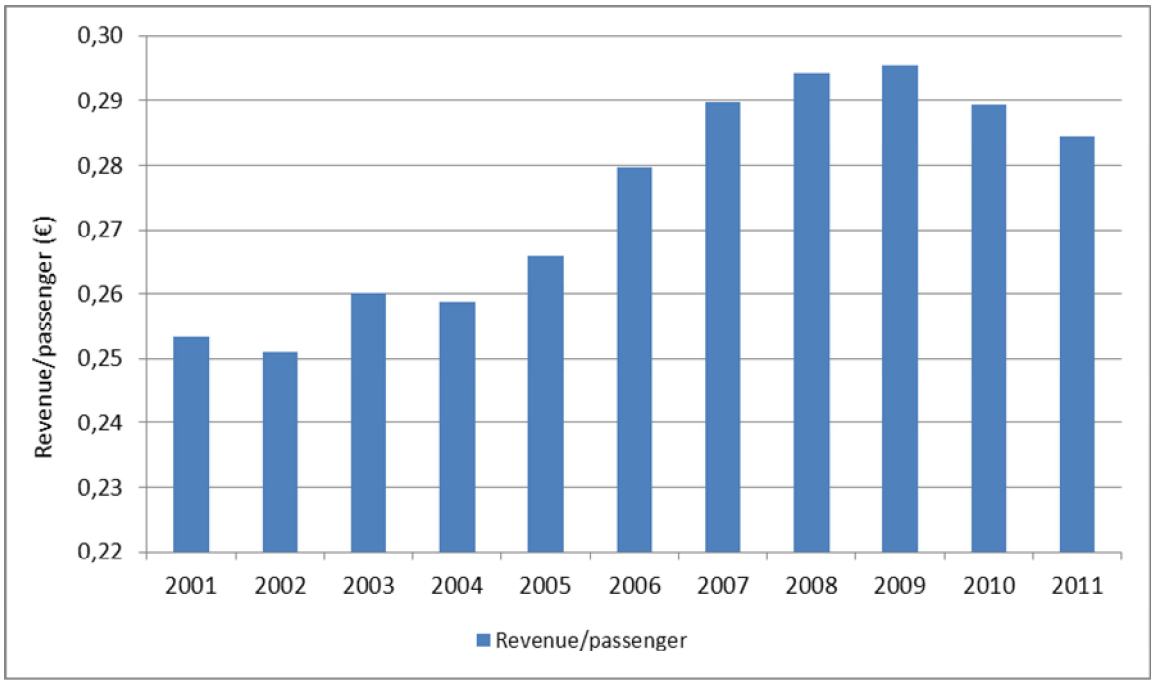


Figure 12 – Renevues per passenger in SMTUC

With the values from the tariff requested to each passenger, with the values available from the number of passengers 2001-2007, together with the BAU scenario for the number of SMTUC passengers (BAU 2) from 2007-2011, and with the values available from the number of vehicle-km, the B-a-U scenario was obtained for the indicator (BAU 2) presented in the next graph:

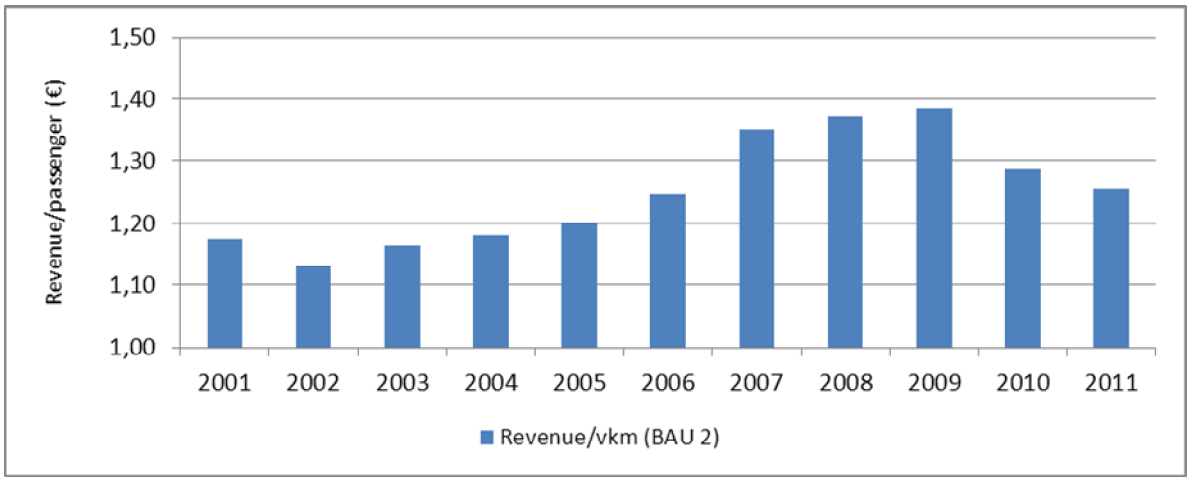


Figure 13 – Renevues per vkm in SMTUC

Therefore, the results of BAU scenario for this case are:

Table 7 – Indicator n.1 – BAU values

Indicators and respective parameters	BAU Values
Average operating revenues (2008)	1,37 €/vkm
Average operating revenues (2009)	1,38 €/vkm
Average operating revenues (2010)	1,29 €/vkm
Average operating revenues (2011)	1,25 €/vkm

Indicator 2 (Average Operating Costs)

In order to determine the B-a-U scenario for this indicator, it was calculated using the available data about total operational cost because the annual series data over the last years is available (in relation to vehicle-km it is considered that extrapolations are not adequate because it is a parameter that is controlled by the operator and not related to the measure). Thus, it is possible to extrapolate for the next few years.

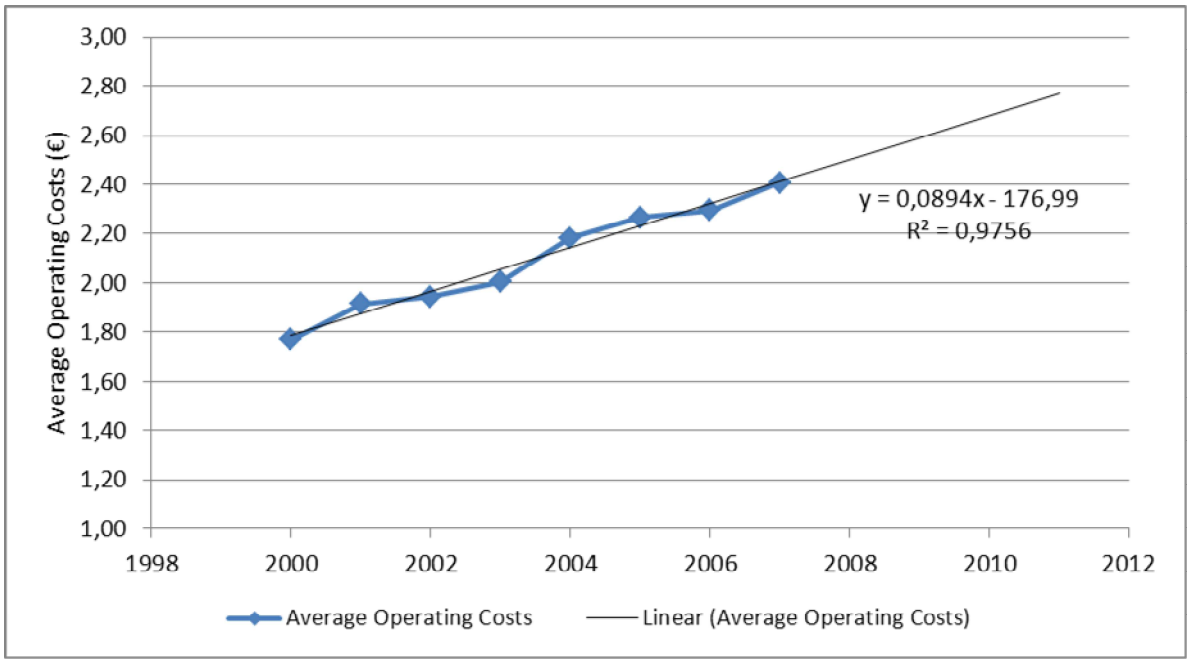


Figure 14 – Operating costs in SMTUC

However,

a) considering the relative low cost of the measure in comparison to the total SMTUC operating costs,

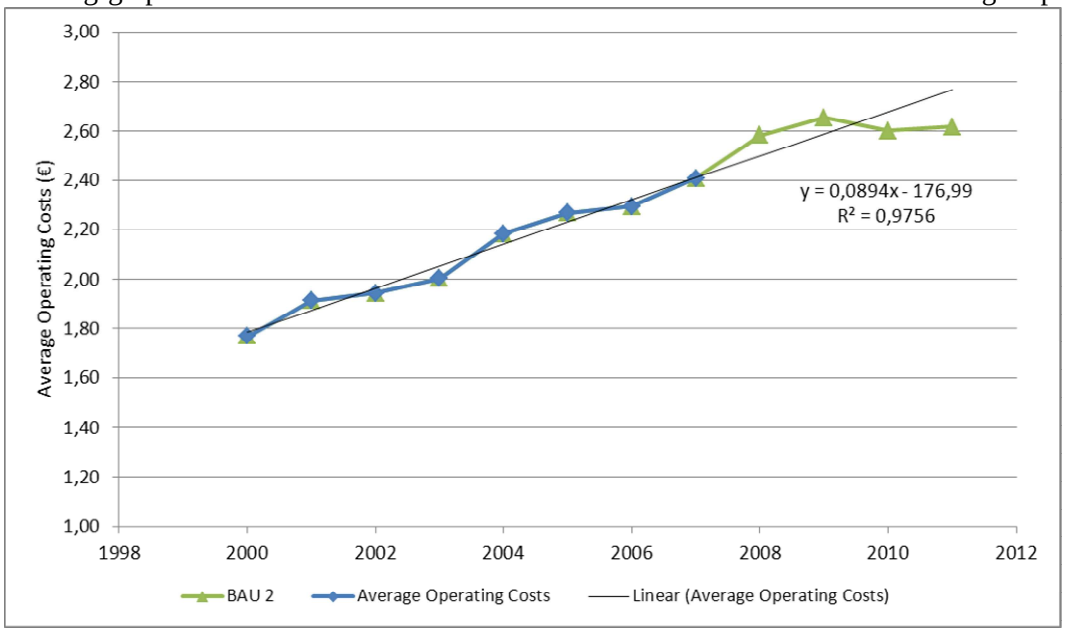
b) considering the increasingly volatile conditions in which SMTUC is operating (including strong variations in fuel prices, labour market regulation reforms, and budget cuts, including salaries related to the public response to the financial crisis) resulting in an increasing variability of costs in time in comparison to the extrapolation of the cost values from the past,

The B-a-U scenario has been redefined (in relation to vehicle-km, again, it was considered that extrapolations are not adequate because it is a parameter that is controlled by the operator and not related to the measure). Therefore, a new approach has been defined to set the B-a-U scenario for this indicator.

One basic consideration in the definition of the new B-a-U scenario is that this measure has no impacts in the total costs of the SMTUC operation beyond, obviously, the added operating cost resulting from the implementation of the measure itself.

Thus, in order to determine the B-a-U scenario, it was considered more adequate to use the already known operating costs resulting from the implementation of the measure itself (upgraded AVM system) and compare with the expected evolution of the operating costs due the former system. This calculation has been made for the Cost Benefit Analyse and is explained in the item C2.6. In the CBA the operating costs balance between the ex-post and the B-a-U scenario results in a decrease of the operating costs (-6.063 €, -6.993 € and -13.353 € in 2009, 2010 and 2011, respectively – see table 31). So de B-a-U is obtained by subtracting these negative values from the total operating costs of the SMTUC operation and then dividing the results by the total vehicle-km.

The following graph shows the evolution obtained for the B-a-U scenario of the Average Operating



Costs – €/vkm (considering the above assumptions the B-a-U scenario coincides with the ex-ante values on the ex-ante period from 2000-2007) and table 8 shows the BAU values.

Figure 15 – Operating costs forecast

Table 8 – Indicator n.2 – BAU values

Indicators and respective parameters	BAU Values
Average operating costs (2008)	2,59 €/vkm
Average operating costs (2009)	2,66 €/vkm
Average operating costs (2010)	2,61 €/vkm
Average operating costs (2011)	2,63 €/vkm

Indicator 3 (Capital Costs)

The change in the capital related to the management and information systems is obtained after setting up the measure. Therefore, if this measure was not implemented, the capital costs would be as before. It was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-Usual is equal to the baseline situation.

The next graph shows the evolution obtained for the B-a-U scenario.

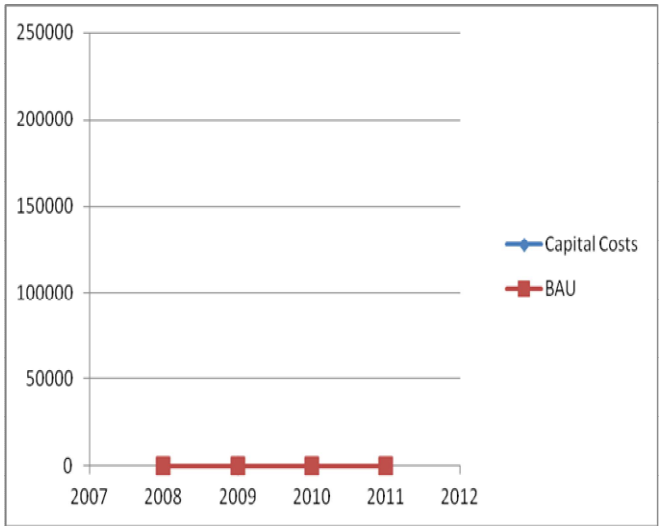


Figure 16 – Capital costs

Therefore, the results of BAU scenario for this case are:

Table 9 – Indicator n.3 – BAU values

Indicators and respective parameters	BAU values
Total capital cost (2008)	0,00 €
Total capital cost (2009)	0,00 €
Total capital cost (2010)	0,00 €
Total capital cost (2011)	0,00 €

Indicator 4 (Percentage of lost trips due to traffic problems)

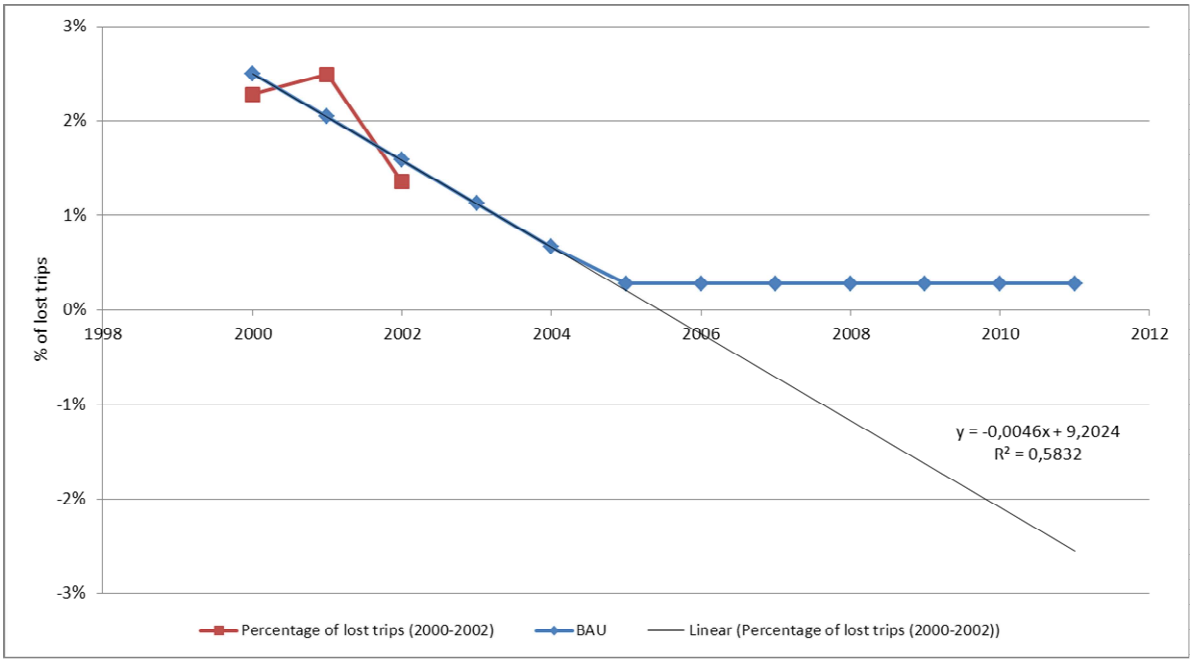
In order to determine the B-a-U scenario for this indicator, the available historical data has been used.

Year	2000	2001	2002	2007
Total scheduled trips (n.)	313061	313061	384794	382232
Total trips lost due to traffic problems (n.)	7133	7800	5236	1062
Trips lost due to traffic problems (%)	2,28	2,49	1,36	0,28

The annual series data is unknown from 2003 to 2006, because during this period only the number total of lost trips has been registered and the reasons for this fact are missing.

For this reason any available information about the evolution of the number of lost trips due to traffic problems in that period was requested from SMTUC. According to the obtained information, in the beginning of this period several modifications were carried out on the operation of the network which

led to a reduction in the number of lost trips due to traffic congestion. According to the same source, the number of lost trips due to traffic problems could be considered as stable before the start of the measure, in accordance with the evolution of the global value of lost trips.



Given this information, the B-a-U scenario has been drawn-up on the assumption that if this measure was not implemented, the percentage of lost trips due to traffic problems from 2000-2005 would follow a linear trend (based on the ex-ante values from 2000-2002) and from 2005-2008 would be constant and equal to the ex-ante value obtained for 2007, according to the following graphs:

Figure 17 – Lost trips forecast

Thus, the percentage of lost trips due to traffic problems after 2007 would be as before. In this period it was considered that there are no effects of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

Table 10 – Indicator n.4 – BAU values

Indicators and respective parameters	BAU Values
Percentage of trips lost due to traffic problems (2008)	0,28 %
Percentage of trips lost due to traffic problems (2009)	0,28 %
Percentage of trips lost due to traffic problems (2010)	0,28 %
Percentage of trips lost due to traffic problems (2011)	0,28 %

Indicator 5 (Average Network Speed)

In order to determine the B-a-U scenario for this indicator, the available historical data has been used because the annual series data of the last few years is available. Thus, it is easy to extrapolate for the next few years.

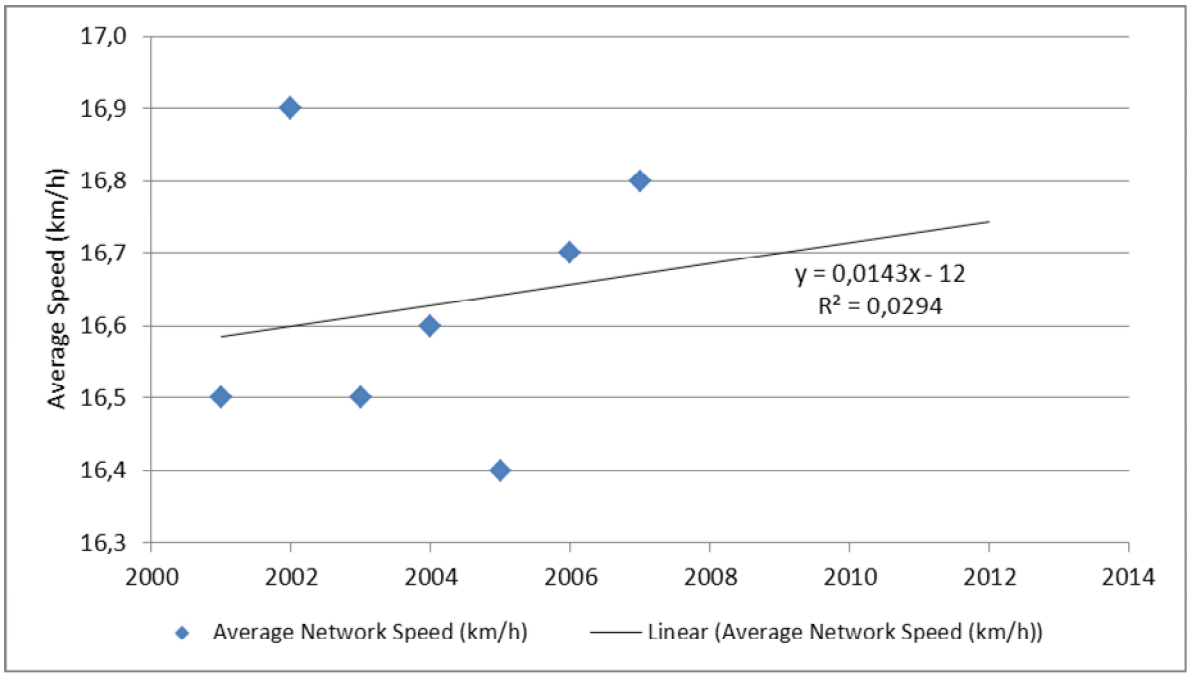


Figure 18 – Average speed forecast

The trend \for forecasting the evolution of passengers shows a low correlation coeficient (0,0294), i.e, a low degree of linear relationship between the two variables. To analyse it more precisley, other types of trends (exponential, logarithmic, polynomial, …) were tested, but at all of them show similar correlation coeficients. Due to this fact the linear trend was choosen as the the one that forecasts the next period.

Therefore, the results of BAU scenario for this case are:

Table 11 – Indicator n.5 – BAU values

Indicators and respective parameters	BAU Values
Average Network Speed (2008)	16,69 km/h
Average Network Speed (2009)	16,70 km/h
Average Network Speed (2010)	16,71 km/h
Average Network Speed (2011)	16,73 km/h

Indicator 7 (Awareness level – users)

The change in the Awareness level – users related to the management and information systems is obtained after setting up the measure. Therefore, if this measure was nor implemented, the Awareness level – users would be as before, i.e equal to zero. Besides this, it is considered that there are no effects

of other factors that have any influence in this indicator. In this case the Business-as-usual is equal to the baseline situation.

Therefore, the results of BAU scenario for this case are:

Table 21 – Indicator n.6 – BAU values

Indicators and respective parameters	BAU values
Awareness level – users (2008)	0 %
Awareness level – users (2009)	0 %
Awareness level – users (2010)	0 %
Awareness level – users (2011)	0 %

C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – economy, energy, environment, society and transport.

C2.1 Economy

In the same way as for the baseline, the results of the indicators have been obtained after the complete implementation of the measure in 2008 for the capital costs resulting of the installation of the upgraded AVM system and in 2009 ("operational management and monitoring of the updated GPS / GPRS – Operation Support System" and launch of the "SMTUC Mobile"). :

The total revenues of the SMTUC PT service were accounted for and then divided by the vehicle-km performed. The total operating costs were also calculated and then divided by the vehicle-km performed. Also the total capital costs were accounted for.

Therefore, the tables 22 to 23 show the ex-post results for these cases.

Table 22 – Indicator n.1 – Ex-post values

Indicators and respective parameters	Ex-Post values
Average operating revenues (2008)	1,40 €/vkm
Average operating revenues (2009)	1,41 €/vkm
Average operating revenues (2010)	1,32 €/vkm
Average operating revenues (2011)	1,31 €/vkm

Table 23 – Indicator n.2 – Ex-post values

Indicators and respective parameters	Ex-Post Values
Average operating costs (2008)	2,59 €/vkm
Average operating costs (2009)	2,66 €/vkm
Average operating costs (2010)	2,61 €/vkm
Average operating costs (2011)	2,63 €/vkm

Table 24 – Indicator n.3 – Ex-post values

Indicators and respective parameters	Ex-Post values
Total capital costs (2008)	241.542,00 €
Total capital costs (2009)	0,00 €
Total capital costs (2010)	0,00 €

Total capital costs (2011)	0,00 €

The table 25 summarise the comparison of the indicators 1, 2 and 3 after the implementation of the measure with the baseline and the BAU scenario.

Table 25 – Summary – Balance between economy indicators (after/before and after/BAU)

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
1. Average Operating Revenues	1,35 €/vehicle-km (2007)	1,37 €/ vehicle-km (2008) 1,38 €/ vehicle-km (2009) 1,29 €/ vehicle-km (2010) 1,25 €/ vehicle-km (2011)	1,40 €/ vehicle-km (2008) 1,41 €/ vehicle-km (2009) 1,32 €/ vehicle-km (2010) 1,31 €/ vehicle-km (2011)	0,05 €/ vehicle-km (2008) 0,06 €/ vehicle-km (2009) -0,03 €/ vehicle-km (2010) -0,04 €/ vehicle-km (2011)	0,03 €/ vehicle-km (2008) 0,03 €/ vehicle-km (2009) 0,03 €/ vehicle-km (2010) 0,05 €/ vehicle-km (2011)
2. Average Operating Costs	2,41 €/vehicle-km (2007)	2,59 €/ vehicle-km (2008) 2,66 €/ vehicle-km (2009) 2,61 €/ vehicle-km (2010) 2,63 €/ vehicle-km (2011)	2,59 €/ vehicle-km (2008) 2,66 €/ vehicle-km (2009) 2,61 €/ vehicle-km (2010) 2,63 €/ vehicle-km (2011)	0,18 €/ vehicle-km (2008) 0,25 €/ vehicle-km (2009) 0,20 €/ vehicle-km (2010) 0,22 €/ vehicle-km (2011)	0,00 €/ vehicle-km (2008) 0,00 €/ vehicle-km (2009) 0,00 €/ vehicle-km (2010) 0,00 €/ vehicle-km (2011)
3. Capital Costs	0,00 € (2007)	0,00 € (2008) 0,00 € (2009) 0,00 €	241542,00 € (2008) 0,00€ (2009) 0,00 €	241542,00 € (2008) 0,00€ (2009) 0,00 €	241542,00 € (2008) 0,00€ (2009) 0,00 €

		(2010) 0,00 € (2011)	(2010) 0,00 € (2011)	(2010) 0,00 € (2011)	(2010) 0,00 € (2011)

The following graph shows the evolution of average operating revenues (€/vkm) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

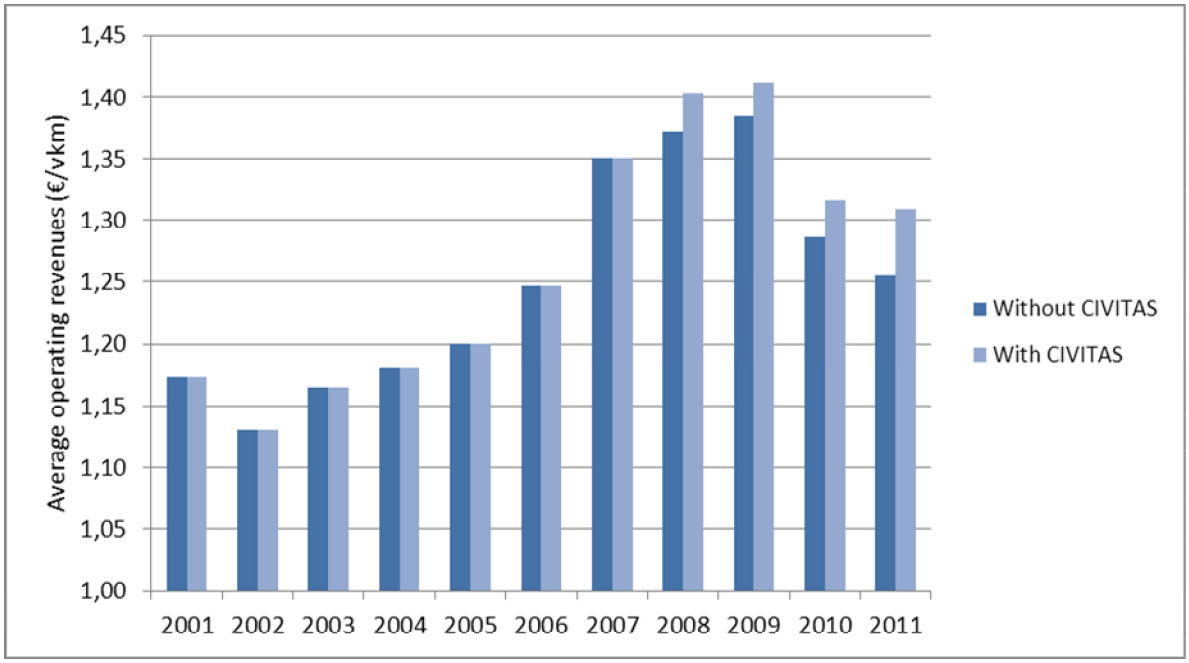


Figure 19 – Average operating revenues without/with Civitas

The following graph shows the evolution of average operating costs (€/vkm) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

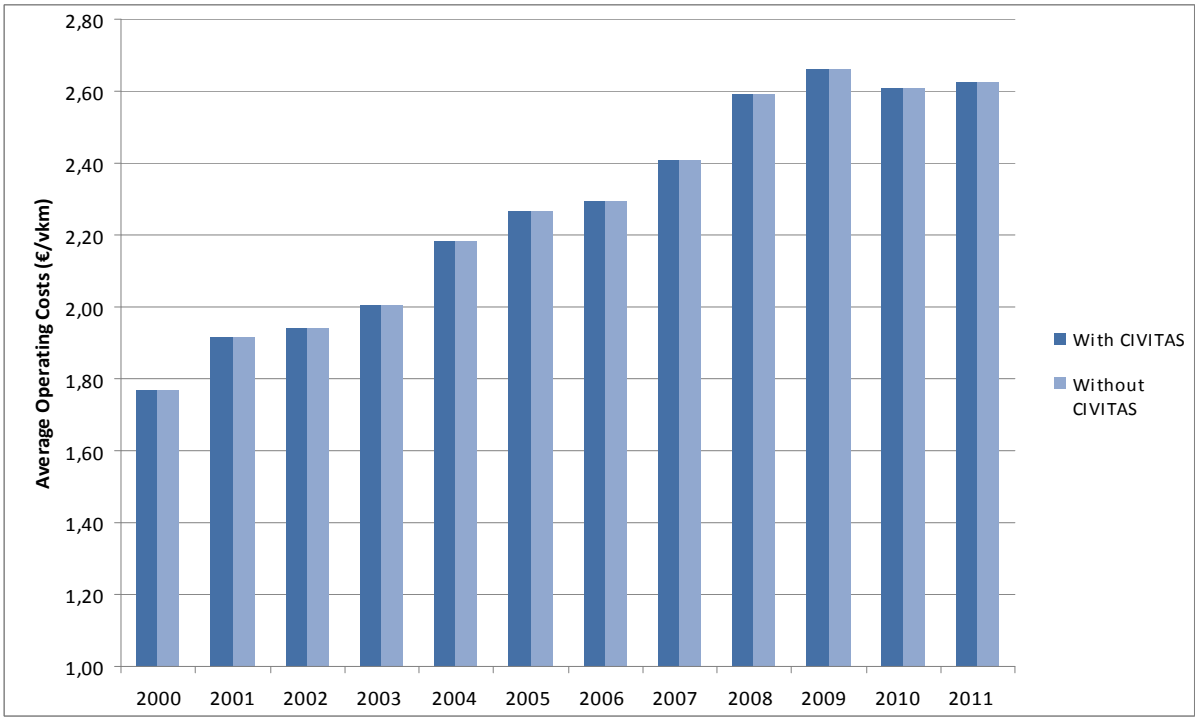


Figure 20 – Average operating costs without/with Civitas

The following graph shows the evolution of capital costs (€) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

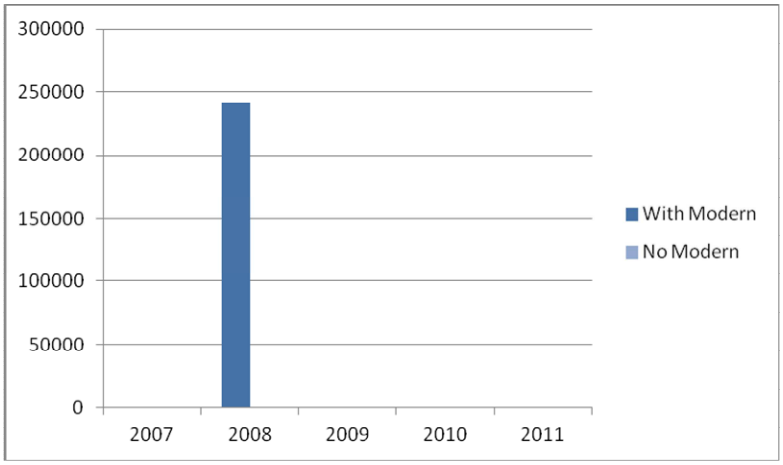


Figure 21 – Capital costs without/with Civitas

The improvements introduced along with the measure implementation were not enough to avoid the reduction of the number of passengers and, thus, in revenues in this period. However, together with other measures, they avoided an even greater drop and revealed to be efficient by contributing to a greater increase in average operating revenues in comparison to the B-a-U scenario

The balance of the average operating costs between the results and the B-a-U is null, despite the reduction of the operating costs with the measure implementation. The motive is the low value of this

decrease comparatively to the total amount of the operating costs of all SMTUC PT service. Anyway the increase in the operating costs comparatively the baseline results of exogenous factors (mainly the great increase in the fuel costs) and not of the measure impacts.

As expected, capital costs experienced an increase as a result of the implementation of the measure in comparison to the B-a-U scenario,, but only a Cost-Benefit Analysis could conclude if the gains in the average operating revenues and the decrese in the operating costs added to the evolution in the external costs are enough for the payback of the investiment.

C2.4 Transport

In the same way as for the baseline, the results of the indicators have been obtained after the complete implementation of the measure in 2009 ("operational management and monitoring of the updated GPS / GPRS – Operation Support System" and launch of the "SMTUC Mobile"). These are the results of indicators 4 and 5 (tables 25 to 27):

Indicator 4 (Percentage of lost trips due to traffic problems)

Table 25 – Indicator n.4 – Ex-post values

Indicators and respective parameters	Ex-Post Values
Percentage of trips lost due to traffic problems (2008)	0,28 %
Percentage of trips lost due to traffic problems (2009)	0,21 %
Percentage of trips lost due to traffic problems (2010)	0,15 %
Percentage of trips lost due to traffic problems (2011)	0,23 %

Indicator 5 (Average Network Speed)

Table 26 – Indicator n.5 – Ex-post values

Indicators and respective parameters	Ex-Post Values
Average Network Speed (2008)	17,0 km/h
Average Network Speed (2009)	17,0 km/h
Average Network Speed (2010)	17,1 km/h
Average Network Speed (2011)	17,1 km/h

These results show that the measure had a positive impact both in terms of the reduction of the percentage of trips lost due to traffic problems (thus contributing to the increase of Accuracy of PT timekeeping) and in terms of the increase in the Average Network Speed.

Table 27 – Summary – Balance between transport indicators (after/before and after/BAU)

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U

4. Percentage of lost trips due to traffic problems	0,28 % (2007)	0,28% (2008) 0,28% (2009) 0,28% (2010) 0,28% (2011)	0,28 % (2008) 0,21 % (2009) 0,15 % (2010) 0,23% (2011)	0,00 % (2008) - 0,07 % (2009) - 0,13 % (2010) - 0,05 % (2011)	0,00 % (2008) - 0,07 % (2009) - 0,13 % (2010) - 0,05 % (2011)
5. Average Network Speed	16,8 km/h (2007)	16,7 km/h (2008) 16,7 km/h (2009) 16,7 km/h (2010) 16,7 km/h (2011)	17,0 km/h (2008) 17,0 km/h (2009) 17,1 km/h (2010) 17,1 km/h (2011)	0,2 km/h (2008) 0,2 km/h (2009) 0,3 km/h (2010) 0,3 km/h (2011)	0,3 km/h (2008) 0,3 km/h (2009) 0,4 km/h (2010) 0,4 km/h (2011)

The following graph shows the evolution of the percentage of lost trips with CIVITAS and the evolution of this indicator according to the B-a-U scenario (without CIVITAS).

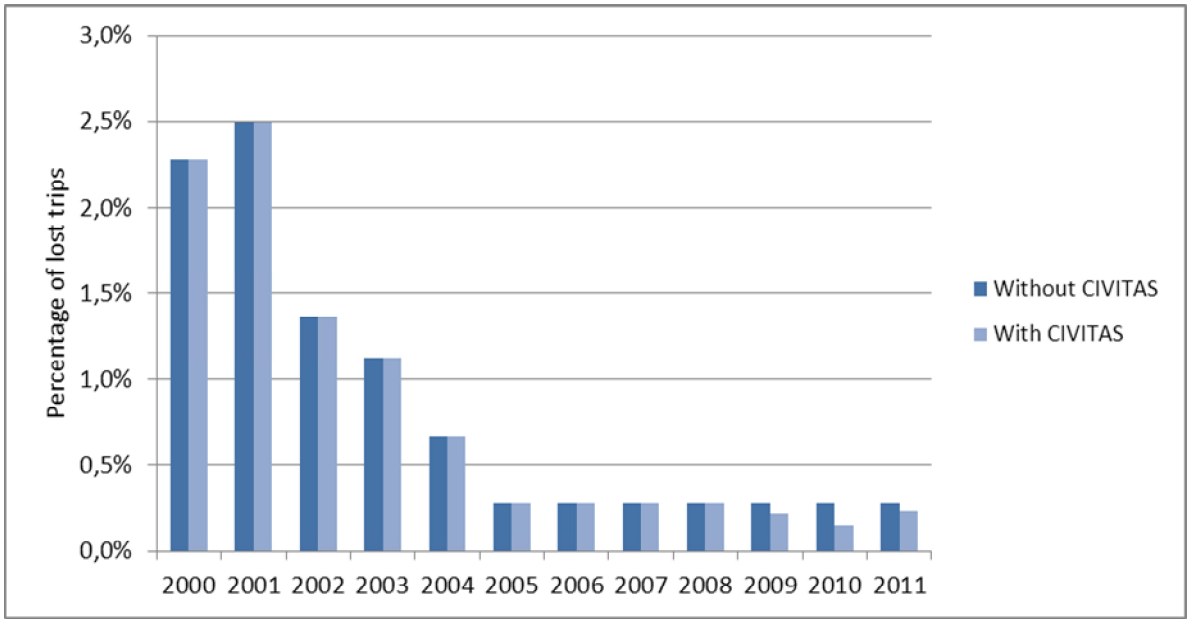


Figure 22 – Percentage of lost trips Without/With Civitas

Observing the previous graph, it can be concluded that the measure had a positive impact in the percentage of lost trips. It can be observed that with the CIVITAS measure the percentage of lost trips has decreased in comparison to the B-a-U scenario 0,07%, 0,13% and 0,05% between 2009, 2010 and 2011, respectively.

But contrary the trend, in 2011 the lost trips had a little increase in relation to 2010 because the traffic conditions worsened very much due to works on the dam-bridge during several months of 2011 and 2012.

Although this positive impact seems of little importance in terms of percentage, it should be noted that the baseline position was already quite low due to the implementation of other measures that contributed to improve the performance of the service before CIVITAS.

In fact, the level was so good that achieving improvements seems to be quite challenging. However, the implemented system helped in achieving the referred to improvement.

Finally, it should be noted that, in spite of a moderate impact from the quantitative point of view, the reduction of the number of lost trips is very relevant from the qualitative point of view and, as such, regardless of the small quantitative impact, investing in improving this aspect of the service seems to be worthwhile.

The following graph shows the evolution of the Average Network Speed (vkm/h) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

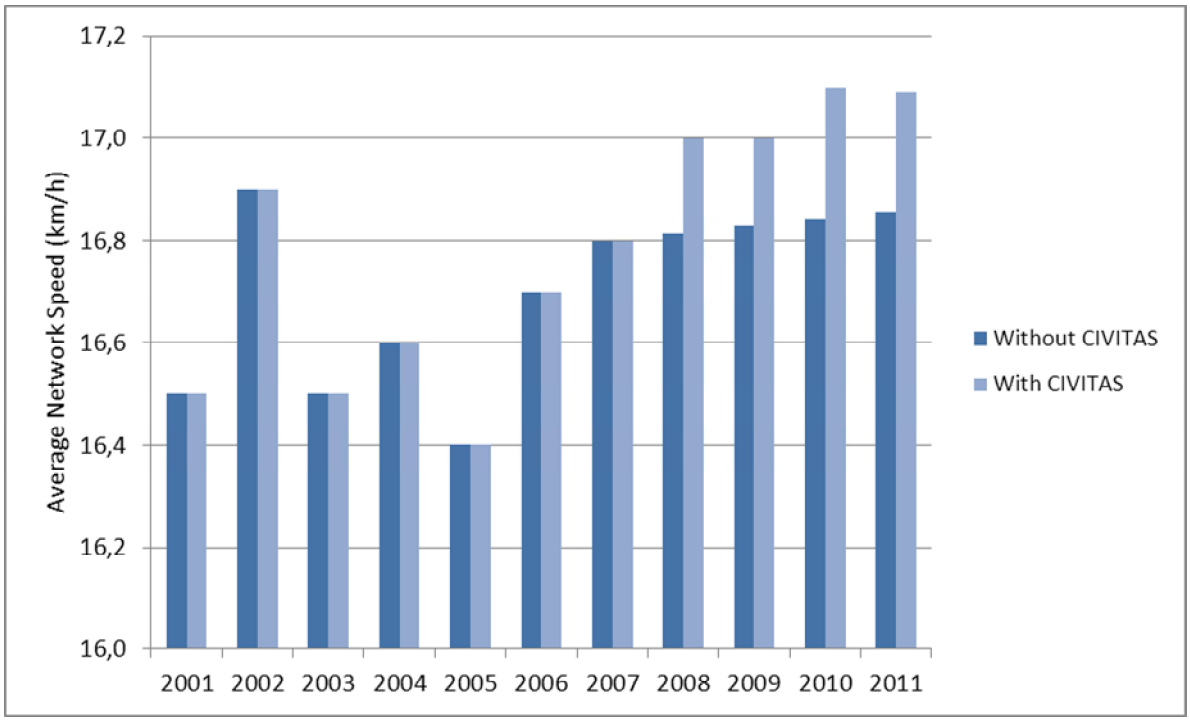


Figure 23 – Average Network Speed Without/With Civitas

The measure had a positive impact in the average network speed. Comparing the results with CIVITAS and without CIVITAS it is possible to observe that the average network speed has increased 1,0%, 1,5%, 1,4%, between 2009, 2010 and 2011, respectively.

It can be difficult to understand the influence of the GPS/GPRS – Operation Support System in the augmentation of the average network speed. According to the measure leader this fact could result from to 2 main factors – 1) a better control of the drivers' service, avoiding superfluous time loss; and 2) a better use of the offer, taking advantage of the greater quantity and accuracy of the data recorded with the real time information about the operations, including the former cases of excessive time loss. With this data it was possible to assess the trips that also had an over-extended travel time and proceed with the adaptation of the time tables with trips that were conducted more quickly. This contributed particularity to increase the transport quality and the economy of resources (buses, fuel, and drivers).

As an example of several other already implemented the measure leader described the changes in the 2 PT lines with more demand (with greater trip offer and frequency) – by shortening the trip time as a result of the analysis of the data provided by the upgraded system it was possible to save 18 operation hours (more than 1 bus and 2 drivers**).**

Another indicator of improvement in the Quality of the PT Service is the decrease in the number of failures of the GPS / GPRS Operation Support System (the major problems assessed were failures in the communication system of the buses).

The following table shows the evolution of the number of average daily failures of the GPS / GPRS Operation Support System per year between 2007 and 2012.

Table 28 – Average daily filures of GPS / GPRS Operation Support System

Year	2007	2008	2009	2010	2011	2012
Daily failures	14,20	9,52	10,50	11,51	9,85	10,91

Source: SMTUC data

The number of average daily failures after the implementation of the measure has been consistently below the 2007 value. This indicates that the measure has been effective in increasing the reliability of the Operation Support System. This system is a critical tool for improving PT operation, being determinant in reducing service disturbances, reducing the number of lost trips, and to increasing the average network speed.

The GPS / GPRS Operation Support System is a critical tool in improving PT operations, being determinant in reducing service disturbance, reducing the number of lost trips, and to increasing the average network speed.

C2.5 Society

To get an assessment about the knowledge towards the changes occuring, specific questions were added to the customer satisfaction survey to PT users carried out in the scope of the Quality Management System of SMTUC (according to the indicator definition above). Thus, the results of the indicators have been obtained after implementing the measure in 2009 (after the conclusion of the "tests phases of the SMTUC Mobile System"). The results of indicator 6 are the following:

Table 29 – Indicator n.6 – Ex-post values

Indicators and respective parameters	Ex-Post values
Awareness level users (2010-03-23 a 2010-03-29)	27%
Awareness level users (2011-03-29 to 2011-04-04)	34%

The table of results of the indicators is as follows:

Table 27 – Summary – Balance between societyindicator (after/before and after/BAU)

Indicator	Before (date)	B-a-U (date)	After (date)	Difference: After –Before	Difference: After – B-a-U
6. Awareness level – users	0 (2009)	0 % (2010) 0 % (2011)	27 % (2010) 34 % (2011)	27 % (2010) 34 % (2011)	27 % (2010) 34 % (2011)

The following graph shows the evolution of the Awareness Level (%) with CIVITAS and the evolution of this indicator according to the B-a-U scenario (Without CIVITAS).

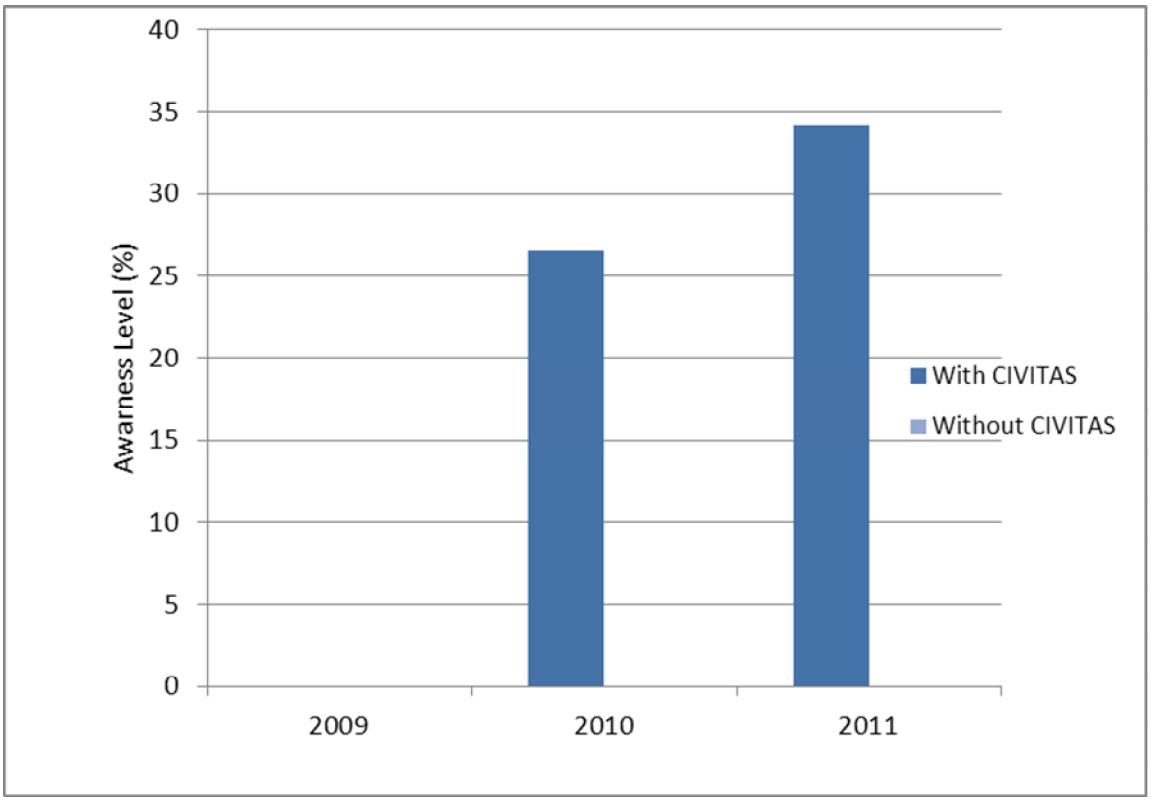


Figure 24 – Awarness level Without/With Civitas

This evolution shows that the awareness level increased steadily along with the implementation of the measure (more rapidly from 2009-2010 than from 2010-2011).

Final remarks:

For several reasons, the achieved results must be considered carefully.

The update of the GPS / GPRS – Operation Support System is of strategic importance not only because of the direct impact in the SMTUC operation but also because it provides the integration with other systems, the majority launched with CIVITAS MODERN (new e-ticketing system, "RUMOS trip planner", "SMTUC Mobile;…).

Nevertheless, it also offers other future opportunities for integration with other systems (e.g. articulation with preferential traffic light regulation). Indeed, some of the possible benefits of the measure could be augmented in the future, after the integration with other systems is implemented and made operational.

Therefore, future evaluation could be carried out extra CIVITAS MODERN to assess those future benefits.

So far, the direct impact of the operation of the GPS / GPRS – Operation Support System resulted as expected in benefits on the percentage of lost trips due to traffic problems and on the average network speed.

However, the improvements achieved with the corresponding limited investment are of course limited and, as such, probably not easily perceived by the users and even less by those not commonly using PT. Besides that, the percentage of lost trips due to traffic problems and the average network speed are just two factors among many others that the users take into account when making their judgments about the quality of the PT service as a whole.

There is a trend for an increasing use of mobile phones to access information. However, the number of people using mobile phones for that purpose was not evaluated, but the awareness level about "SMTUC Mobile" aplication increased from 2010 to 2011. The fact that this application does not need a "smatphone" to run could allow for an increase in its use.

C2.6 Cost benefit analysis

C2.6.1 Evaluation period for CBA

Cost-benefit analysis was conducted using the CBA Guideline for CIVITAS Plus Evaluation (Draft 1.0) document developed by Transportation Research Group (TRG), School of Civil Engineering and the Environment, University of Southampton, UK. The output of the CBA was the Net Present Value (NPV) of the measure, which computes the changes of economic costs and benefits, discounted over the 10 years expected lifetime of the measure, which matches the evaluation period of CBA (2008-2018).

The analysis was performed by comparing the costs and benefits of the GPS/GPRS Operation Support System (CIVITAS Case) with a radio system (BAU Case).

The generated benefit of the technological change is due to the increase of the average PT network speed.

In terms of costs the main beneficiaries were the Control Centre personnel, the maintenance, the communication, and energy of the control centre. The main benefits were the augment in the average PT network speed.

The balance between costs and benefits was computed using the NPV by discounting the aggregated annual cash flow (sum of the 10 year annual cash flows). The discount rate considered is 3% per year.

C2.6.2 Method and values for monetisation

Capital cost for the year 2008 is monetised considering the investment of the new GPS/GPRS Operation Support System.

Operating costs for the years 2009-2018 is monetised considering the value of SMTUC Operating Costs related to the measure. The enrolled costs are the (A.) Control Centre Personnel, the (B.) Maintenance, the (C.) Communication and (D.) Energy of the control centre.

These costs were also updated in the analysis period by considering the following:

Table 28 – Explanation of source and assumptions for construction the CBA analysis

Operating Cost	BAU Case	CIVITAS Case	OBS.
A. Control Centre Personnel	Real value of 2009 and a reduction of 14% in 2012.Stable in 2013-2018 Period	Real value of 2009 and a reduction of 14% in 2012.Stable in 2013-2018 Period	Till reduction of personnel costs is due to the financial crisis with the reduction of salary. Expected stability in 2013-2018 Period
B. Maintenance	Real values in 2009. Expected an increase of 3% per year (2010-2018)	Real values in 2009-2012. In 2010-2018 period is expected a stability in the cost	Estimated by SMTUC
C. Communication	2009 real value. 2010-2018 is expected an increase of 1% per	2009 real value. 2010-2018 is expected an increase of 1% per year	Estimated by SMTUC
D. Energy of the control centre	2009 real value. 2010-2018 is expected an increase of 2,8% per	2009 real value. 2010-2018 is expected an increase of 2,8% per year	2012 Forecast of the Portuguese energy regulator

Time savings from journey time reductions result from the measure. Thus, time savings for BAU situation are monetised considering the value 0 and only exist for CIVITAS measure situations. Time savings from journey time reductions (CIVITAS Measure) are monetised considering the following expression:

$A = B \times C \times (D - E)/(D \times E) \times F$

Where

A – Saving from journey time reduction (€)

B – Average value of time (€/h)

C – Average length of trip per passenger (km)

D – Ex-post values for the Average Network Speed (km/h). The Ex-post values for Average Network Speed (km/h) were used for years 2008-2012, considering that the positive effect of the measure has a limited effect over the Average Network Speed, the value relative to 2012 has been used for analysis period.

E – B-a-U values for indicator 5 Average Network Speed (km/h). The B-a-U values for Average Network Speed (km/h) were used for years 2008-2012; considering that there would be a limit increase trend in the Average Network Speed, the B-a-U value in comparison to 2012 has been used for years 2013-2018.

F – Number of passengers; The Passenger Numbers obtained from SMTUC were used for years 2008-2012; Considering the financial crisis deeply affecting the Portuguese economy and the extensive social changes occurring in Coimbra, with unforeseeable impacts over SMTUC PT demand, the value of the Number of Passengers for 2012 has been used for predicting years 2013-2018.

Considering the unavailability of data about modal shift to PT as result of the measure and admitting that the improvements introduced along with the measure implementation had little influence in the modal split, it has been assumed that during the evaluation period the reductions of environmental emissions would be null. Therefore, savings from reductions of environmental emissions for years 2008-2018 are monetised considering the value 0 both for CIVITAS measure and BAU.

It should be acknowledged that between 2008-2011 other measures with potential impacts over passenger numbers (and therefore, over revenue and benefits from time savings) were implemented in Coimbra. In this period, the most relevant external change (in relation to this measure) over the SMTUC service is the start of the start-up of the Infomobility Centre (on 15th September 2009) and of the RUMOS system (October 2009), on the scope of CIVITAS MODERN Measure 04.02 – Infomobility Centre and Mobility Marketing in Coimbra. However, considering the potential limited impact over passenger numbers resulting from those changes, the assumption is that the CBA results are not (significantly) affected.

The values for the benefit are showed in the following table.

Table 29 –Determinations of the benefit in the CBA analysis

Year	Time Savings (€/h)	Average length of trip (km)	Average Speed – BAU (km/h)	Average Speed – CIVITAS (km/h)	Number of passengers (N.)	Benefit (€)
2008	11,53	3,56	16,7	17,0	27.689.418	1.260.673,09
2009	11,53	3,56	16,7	17,0	27.220.764	1.181.990,29
2010	11,53	3,56	16,7	17,1	26.937.520	1.493.816,11
2011	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2012	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2013	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22

2014	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2015	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2016	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2017	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22
2018	11,53	3,56	16,7	17,1	27.077.853	1.406.674,22

References of values used - Time Savings

The average length of trip per passenger considered is of 3,563 km – This value is obtained by dividing the value of passenger-km on the SMTUC network in comparison to 2008 (Source: IMTT, Barómetro da Mobilidade, 2009) by the total number of passengers in comparison to 2008 obtained from SMTUC (see annex 1 Average Revenues Data).

The pondered Average value of time (€/h) is obtained considering the following:

$B = (H \times I + J \times K) / (H + J)$ where:

H – Proportion of passengers travelling for work related motives (47%)

I – Average value of time for passengers travelling for work related motives (18,19 €/h)

J – Proportion of passengers travelling for non-work related motives (53%)

K – Average value of time for passengers travelling for non-work related motives (5,64 €/h)

This implies that the value of time is **11,53€/h** (for more detail consult ANNEX 8 Cost-Benefit Analysis Data).

C2.6.3 Life time cost and benefit

Tables 30 to 33 shows the economic data used for the Cost Benefit Analyse.

Table 30 – Capital cost in the evaluation period (not discounted)

Year	CIVITAS measure	BAU
2008	241.542,00	0,00
2009	0,00	0,00
2010	0,00	0,00
2011	0,00	0,00
2012	0,00	0,00
2013	0,00	0,00
2014	0,00	0,00
2015	0,00	0,00
2016	0,00	0,00
2017	0,00	0,00

Table 31 –Costs in the evaluation period (not discounted)

		0 2008	1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018
A. Control Centre Personnel	CIVITAS Case	0	127.605	127.605	127.605	109.740	109.740	109.740	110.837	111.946	113.065	114.196
	BAU Case	0	127.605	127.605	127.605	109.740	109.740	109.740	110.837	111.946	113.065	114.196
B. Maintenance	CIVITAS Case	0	21.600	21.600	16.200	18.000	18.000	18.000	18.000	18.000	18.000	18.000
	BAU Case	0	30.040	30.941	31.870	32.826	33.811	34.825	35.870	36.946	38.054	39.196
C. Communication	CIVITAS Case	0	11.287	11.400	11.514	11.629	11.745	11.863	11.982	12.101	12.222	12.345
	BAU Case	0	7.596	7.672	7.749	7.826	7.905	7.984	8.064	8.144	8.226	8.308
E. Energy (Control Centre)	CIVITAS Case	0	4.830	5.071	5.325	5.591	5.871	6.164	6.473	6.796	7.136	7.493
	BAU Case	0	6.144	6.451	6.774	7.112	7.468	7.841	8.233	8.645	9.077	9.531
TOTAL (€)	CIVITAS Case	0	165.322	165.676	160.644	144.960	145.356	145.767	147.291	148.843	150.424	152.033
	BAU Case	0	171.385	172.669	173.997	157.505	158.923	160.390	163.004	165.681	168.422	171.231
Changes (€)		**0**	**-6.063**	**-6.993**	**-13.353**	**-12.544**	**-13.567**	**-14.623**	**-15.713**	**-16.838**	**-17.999**	**-19.198**

Note: The decrease in the maintenance costs since 2011 was due to a renegotiation of the maintenance contract with the system supplier, due the greater reliability of the new system. In the other hand the costs in the communications increased with the new system caused by the change between a proprietary communication system (analogical) by a service contractualised with an operator.

Table 32 - Savings for the evaluation period (not discounted)

		0 2008	1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018
Vehicle Speed	CIVITAS Case	1.260.673	1.181.990	1.493.816	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674
	BAU Case	0	0	0	0	0	0	0	0	0	0	0
TOTAL (€)	CIVITAS Case	1.260.673	1.181.990	1.493.816	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674
	BAU Case	0	0	0	0	0	0	0	0	0	0	0
Changes (€)		**1.260.673**	**1.181.990**	**1.493.816**	**1.406.674**	**1.406.674**	**1.406.674**	**1.406.674**	**1.406.674**	**1.406.674**	**1.406.674**	**1.406.674**

Table 33 – Balance between costs and benefits due to measure (lifetime period)

	0 2008	1 2009	2 2010	3 2011	4 2012	5 2013	6 2014	7 2015	8 2016	9 2017	10 2018
Undiscounted Cash Flow (€)											
Changes in total costs	241.542	-6.063	-6.993	-13.353	-12.544	-13.567	-14.623	-15.713	-16.838	-17.999	-19.198
Changes in total benefits	0	1.181.990	1.493.816	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674	1.406.674
Net Cash Flow	-241.542	1.188.054	1.500.810	1.420.028	1.419.218	1.420.241	1.421.297	1.422.387	1.423.512	1.424.673	1.425.872
Discounted Cash Flow (€)											
Changes in total costs	241.542	-5.887	-6.592	-12.220	-11.145	-11.703	-12.246	-12.776	-13.292	-13.795	-14.285
Changes in total benefits	0	1.147.563	1.408.065	1.287.306	1.249.812	1.213.410	1.178.068	1.143.755	1.110.442	1.078.099	1.046.698
Net Cash Flow	-241.542	1.153.450	1.414.657	1.299.526	1.260.957	1.225.113	1.190.314	1.156.531	1.123.733	1.091.893	1.060.983
Cumulative cash flow	-241.542	911.908	2.326.565	3.626.092	4.887.049	6.112.161	7.302.475	8.459.006	9.582.739	10.674.633	11.735.615
Changes in NPV (€)	**11.735.615**										

C2.6.5 Summary of CBA results

The results of CBA demonstrate that the measure produces a NPV of 11,6 M € over a 10 year period analysis, based on the updated balance of costs and benefits of the GPS/GPRS Operation Support System (CIVITAS Case) with a radio system (BAU Case).

In order to evaluate the sensitivity due to the discount rate an analyses will be carried out (table 34). A 3% rate per year was assumed and 2 scenarios will analyse a high discount rate with 5,5% and a low discount rate (2,5%)

Table 34 – Sensivity analysis (low and high scenario)

Analysis	NPV (M€)
Low (discount rate 2,5%)	12,05
Current (discount rate 3%)	11,74
High (discount rate 5%)	10,58

By analysing the sensitivity, the analysis demonstrated that the discount rate has a small impact in the NPV and it always remains positive.

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To implement an updated GPS/GPRS Operation Support System, with new equipment on board 125 buses and to renewal 12 existing real time passenger information panels in order to allow more accuracy in real time information - less than 1 minute gap to update the information - and better commercial speed - increase by 0,5% in the SMTUC PT network. An updated GPS/GPRS Operation Support System with new equipment was installed on board 125 buses and 12 existing real time passenger information panels were renewed, resulting in more accuracy in real time information - less than 1 minute gap to update the information - and better commercial speed - increase by 2,4% in the SMTUC PT network	***
2	To install 6 new generation real time passenger information panels 6 new generation real time passenger information panels were installed	**
3	To develop 1 mobile phone application for passenger information (PT timetables consult). 1 mobile phone application for passenger information (PT timetables consult) was developed	**
4	The better real time transport network management also could allow to surpass the 99,5% real supply relatively to the one programmed. The improved real time transport network management allowed to largely surpass the 99,5% real supply (in comparison with the programmed trips) – from 2008 to 2011 this value ranged between 99,72% and 99,85%.	***
NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%) ** = Achieved in full * = Exceeded**		

C4 Up-scaling of results

The GPS / GPRS – Operation Support System and the SMTUC Mobile System were implemented on the whole SMTUC network which covers the entire city of Coimbra, so there is no need to expand this kind of measure to other areas of the city.

Concerning the measure replication, we can highlight that the Portuguese City of Braga has also implemented the application "SMTUC Mobile" after the success of this product in Coimbra. Also, the fact that SMTUC and the application developer didn't have any revenues coming from this implementation facilitated the transfer of technology.

C5 Appraisal of evaluation approach

The evaluation strategy of this measure sought to focus on a number of indicators across the areas of economy, transport and society, which were to be measured in different ways.

The unavailability of information about modal split in Coimbra and the fact that a survey to assess this impact concerning all the inhabitants of Coimbra would be very expensive determined the exclusion of the indicator modal split. Due to the fact that the first yearly Customer Satisfaction Survey integrated in the Quality Management System of SMTUC has been carried out between December 2008 and January 2009, it was impossible to assess the ex-ante data of the Quality of PT Service and Acceptance Level – Users and the exclusion of these indicators was determined.

The unavailability of ex-ante data about modal split also determined the exclusion of any energy or environment related indicator on this measure.

The final phase of the evaluation process determined the redefinition of the indicators Average Operating Revenues and Average Operating Costs. These were limited to those directly related to the measure and in the final version are related to the overall SMTUC PT service because it was considered the best solution for allowing for the comparison of results.

Also the indicator Accuracy of PT Timekeeping was redefined and changed to "Percentage of lost trips due to traffic problems" because it has been considered the best way to evaluate this impact.

These redefinitions resulted necessarily in the redefinition of the B-a-U scenario for these indicators.

The relative low cost of the measure in comparison to the total SMTUC operating costs, the increasingly volatile conditions in which SMTUC is operating (including strong variations in fuel prices, labour market regulation reforms and budget cuts including salaries related to the public response to the financial crisis) resulting in increasing variability of costs throughout time in comparison to the extrapolation of the cost values from the past, made it impossible to follow the initial approach and determined the option to define other approach, in which the added operating cost resulting from the implementation of the measure itself are subtracted to the total operating costs of the SMTUC operation.

C6 Summary of evaluation results

The key results are as follows:

- **Low average operating costs** – As expected, capital and average operating cost increased as the result of the implementation of the measure, although the contribution of the measure to the increase in the average operating cost has been insignificant (0,01 €/ vehicle-km).
- **Decrease of lost trips** – The implementation of the measure resulted in the decrease of the percentage of lost trips due to traffic problems (which was already quite low in the baseline position due to the implementation of other measures that contributed to improve the performance of the service before CIVITAS) and in spite of a moderate impact from the quantitative point of view, the reduction of the number of lost trips is very relevant from the qualitative point of view. The reduction of lost trips was 0,07 %, 0,13 %, 0,05 % in 2009, 2010, 2011, respectively.
- **Increase of average PT network speed** – The implementation of the measure resulted in the increase of the average network speed, bringing time savings to current passengers and increasing the attractiveness of PT and thus contributing to a modal shift favouring PT service and an increase in revenues. The increase of average PT network speed was 0,3 km/h (2009) and 0,4 km/h (2010, 2011).
- **Increase of awareness level** – The awareness level increased steadily along with the implementation of the measure (more rapidly from 2010-2011 than from 2009-2010); this reveals the importance of measure implementation to raise awareness. The awareness level increases 27 % in 2010 and 34 % in 2011.
- **GPS/GPRS – Operation Support System generates an economic value–** The results of CBA show a NPV of 11,74 €. This means that the savings from journey time reduction and increase in operating revenues are enough to compensate the increase in operating costs and the capital costs due to the implementation of the measure. Furthermore a sensitivity analysis was performed and showed that the discount rate had a small influence on NPV.
- **Tailored monitoring should be developed** – Considering the expectable time necessary for the measure to enter in everyday life of the general population of the city (e.g., time necessary for the population to know and get used with the new information panels) and the overlapping with other measures meanwhile implemented, future monitoring could be made extra CIVITAS project to fully assess the evolution in the (direct) impact of the measure in terms of ridership, revenue, emissions reduction, and energy savings.

C7 Future activities relating to the measure

It is expected that the system will keep in full operation, maintaining the same standards with which it currently works.. The PT SMTUC operator is preparing the acquisition of at least 3 additional panels during 2012. The SMTUC operator is preparing also for the implementation during this year of another mobile phone application with real time information.

SMTUC will complete the feasibility study by adding an assessment of the economic and environmental benefits related to the integrated management of the city traffic lights.

D Lessons learned

D0 Measure / focussed measure

1	The measure fits into the EU policy towards clean urban transport (five pillars of the EU Green Paper)
2	The measure fits into the city policy towards sustainable urban transport and / or towards sustainability in general
3	The expected impact on the transport system, environment, economy and/ or society / people is very high
4	The high level of innovativeness of the measure with respect to technique, consortium, process, learning etc
5	The measure is typical for a group of measures or a specific context
6	The possibility of carrying out a good Cost Benefit Analysis
7	Participation of a range of different actors
8	The high degree of complexity of managing the measure
9	The measure is regarded as an example measure
10	Other, *please describe????*

Which are the three most important reasons for selecting this measure as a focused measure?

2 The measure fits into the city policy towards sustainable urban transport and sustainability in general	1	Most important reason
1 The measure fits into the EU policy towards clean urban transport (five pillars of the EU Green Paper)	2	Second most important reason
5 The measure is typical for a group of measures	3	Third most important reason

D1 Deviations from the original plan

The deviations from the original plan comprised:

- **Implementation of a mobile phone application instead of the feasibility study for its implementation** – Despite that in the original work plan it was only foreseen developing a feasibility study to implement an application that supplies PT timetables on mobile phones, it was decided to develop and implement this application during CIVITAS.
- **Purchase of 6 new generation e-panels with real time information for PT passengers instead of the 12 initially foreseen** – The financial crisis in Portugal caused all national funding for this area to be reduced and, accordingly, national funding has been not available and SMTUC will have to assume alone the financial compromises for the major part of the large investments in the CIVITAS measures. This fact delayed the rhythm of purchase of new e-panels, contributing to the fact that until May 2012 only 6 of the 12 e-panels foreseen were purchased (despite that the purchase of 3 more are planned until the end of CIVITAS).
- **The feasibility study for the application of Galileo System wasn't produced** – Due to the fact that the Galileo system was not yet available and there was little technical information about its operating method at the preparation phase of the measure, the GPS/GPRS – Operation Support System was implemented with the standard procedure, but with the possibility of applying this technology in the future.
- **The technical study about traffic light priority for PT was made with delay** – External factors, like traffic modifications and tram implementation studies that have implications with traffic light systems in Coimbra, delayed the production of the technical study about traffic light priority for PT. Nevertheless, this delay did not have any implication in the other tasks or measures of CIVITAS MODERN project.

D2 Barriers and drivers

D2.1 Barriers

Preparation phase

The preparation phase occurred before CIVITAS start-up – Regardless, during this period the following barrier was detected:

- **Barrier 1.1** – **Technological Barrier:** Due to the fact that the Galileo system was not yet available and there was little technical information about its operating method at the preparation phase of the measure, the GPS/GPRS – Operation Support System was implemented with the standard technology. For this external reason the initial objective of applying the Galileo technology was not achieved

Implementation phase

Great part of the implementation phase occurred before CIVITAS start-up – During this period was detected the following barriers (after CIVITAS start-up):

- **Barrier 2.1** – **Financial Barrier:** The financial crisis in Portugal didn't allow any national funding for the major part of the investments in the CIVITAS measures. For this reason SMTUC assumed by itself these investments. However, the rate of purchase of new e-panels decreased, leading to the fact that until May 2012 only 6 of the 12 e-panels foreseen had been purchased.

- **Barrier 2.2** – **Technological Barrier:** External factors, like traffic modifications and tram implementation studies that have implications with traffic light systems in Coimbra, delayed the production of the technical study about traffic light priority for PT. Nevertheless, this delay did not have any implication in the other tasks or measures of CIVITAS MODERN project

Operation phase

- **Barrier 3.1** – **Technological Barrier:** In the beginning some technical failures that compromised the GPS / GPRS – Operational Support System reliability occurred.

D2.2 Drivers

Preparation phase

The preparation phase occurred before CIVITAS start-up – Regardless of this fact, this period detected the following drive:

- **Driver 1.1** – **Problem related Driver:** The lack of reliability and accuracy of the previous analogical Operation Support System forced the decision to carry out the upgrade to a GPRS system as soon as possible.

Implementation phase

- **Driver 2.1** – **Technological Driver:** The presentation by a student of a beta version of an application that supplies PT timetables on mobile phones (that he wanted to offer to SMTUC) allowed SMTUC to carry on the final development of the application.

Operation phase

- **Driver 3.1** – **Financial Driver:** Availability of CIVITAS for the management and monitoring of the GPS/GPRS Operation Support System.

D.2.3. Activities

Preparation phase

- **Activities 1** – **Planning Activities:** To mitigate the effects of the impossibility of waiting for the release of the Galileo System (barrier 1.1), the suppliers of the upgrade for the GPS/GPRS Operation Support System analysed the specifications and designed the referred update to allow for a migration to Galileo System in the future.

- **Activities 2** – **Problem related Activities:** Due the urgency in the migration to the GPRS Operation Support System caused by the problems referred in the driver 1.1, it was decided to begin with the migration without waiting for the beginning of the CIVITAS MODERN project.

Implementation phase

- **Activities 1** – **Planning Activities:** Due the financial problems reported in barrier 2.1, the acquisition in the first phase of only 1 e-panel for the bus stops and 5 e-panels for interiors was carried out so as to avoid ending the CIVITAS MODERN project without any purchase of e-panels, . The e-panels for interiors are cheaper, but are also very useful.

- **Activities 2** – **Technological Activity:** Despite in the original work plan it was only foreseen to develop a feasibility study to implement an application that supplies PT timetables on mobile phones, the opportunity given by a proposal for the development of the application with low costs (driver 2.1), caused SMTUC develop and implement this application during CIVITAS.

Operation phase

- **Activities 1** – **Technological Activities:** To avoid the problems of reliability of the system related in the barrier 3.1, a rigorous monitoring of the system failures has been carried out with the control centre personnel supported by SMTUC and CIVITAS (drive 3.1) and a new version of the system software was launched, allowing for the system to run in better conditions and with few failures.

- **Activities 2** – **Financial Activities:** The involvement of SMTUC concerning the guarantee of the infrastructure maintenance and the personnel costs of the Centre, aided by CIVITAS during the first 3 years (driver 3.1), also contributed to the maintenance of all public transport operators in the Centre and for the achievement of the objectives defined, helping to reduce the effects of the barrier 3.1.

D3 Participation of stakeholders

D.3.1 Measure partners

- **Measure partner 1 - Serviços Municipalizados de Transportes Urbanos de Coimbra (SMTUC); Public transport company; Leading role**

  SMTUC was responsible for the specification, acquisition and installation process of the GPS / GPRS Operation Support System upgrade, as well as the training of the system users (drivers, controllers, and maintenance staff). Also, SMTUC has carried out the management of operational and monitoring activities.

  Integrated in this system are 6 new real-time public information e-panels which SMTUC has purchased and is responsible for installing.

  SMTUC was also involved in the development and implementation of the mobile phone application "SMTUC Mobile" and supported the Municipality (CMC) in the development of the technical study on traffic light priority for PT, as well as on the compatibility tests between the traffic light management system and the GPS/GPRS Operation Support System.

- **Measure partner 2 – Câmara Municipal de Coimbra (CMC); City; Principle participant**

  CMC was responsible for carrying out the technical study on traffic light priority for PT and the compatibility tests between the traffic light management system and the GPS/GPRS Operation Support System.

  Since October 2011, CMC assumed the responsibility for the dissemination of the MODERN project of Coimbra.

- **Measure partner 3 – Prodeso Ensino Profissional, Lda (PRODESO); High school; Principle participant**

  While responsible for the dissemination activities for the first three years of the MODERN project of COIMBRA, PRODESO gave some support in the promotion of this measure.

- **Measure partner 4 – Perform Energia, Lda (PE); Private company; Principle participant**

  PE was the partner responsible for the evaluation of this measure, namely analysing data and results.

D.3.2 Stakeholders

- **Stakeholder 1 – Public transport users**

  SMTUC passengers are the main beneficiaries of this measure since it has allowed for an enhancement of the quality and feasibility of the real-time management of the PT network and the information provided to the general public.

- **Stakeholder 2 – Supplier of the GPS / GPRS Operation Support System**

BCCM was the supplier of the GPS / GPRS Operation Support System and the e-panels for real time information to the passengers, as well as being co-responsible for its integration with other systems.

- **Stakeholder 3 – Supplier of the new e-ticketing system**

  NOVA BASE was the supplier of the new e-ticketing that was integrated with the GPS / GPRS Operation Support System, namely allowing a single console to command both systems and to receive information about the coordinates of the bus stops for the geo-referencing of passenger entrances.

- **Stakeholder 4 – Associação de invisuais e ambliopes**

  The association for the visually impaired participated in several working sessions with SMTUC during the specification and implementation stage of the GPS/GPRS Operation Support System, in order to assist in optimising the audible information in the interior of the buses and in the e-panels placed at the bus stops.

D.4 Recommendations

D.4.1 Recommendations: measure replication

- **The upgrade of Operation Support Systems with analogical communication technology could be a good solution and an alternative to the implementation of an entire new system –** The upgrade of the Operation Support System to GPRS technology is recommended for transport companies that possess more obsolete technologies (i.e., analogical communication systems in large fleets) which hinder the quality of the fleet management and the public information offered to their customers. SMTUC has verified that intervals equal to/superior to 2 minutes in the updating of the information results in imprecise information for the control centre operators and for the general public through the e-panels. When there is a break in communications that interval may reach 4 minutes, aggravating this phenomenon. The investment needed for the system upgrade is not very significant and is substantially inferior to the costs of acquiring a new system. And in the case of Coimbra, the upgrade solved the operational needs perfectly. The improvement of the information update interval is also essential in case there is the need for integration with the traffic light priority system.

- **Analogical systems are not recommended in case of implementation of real time infomobility tools –** The migration to a GPRS system is also important is case of wanting to offer on-line travel planning services in real-time, namely on mobile phones. The reliability of the service depends on the quantity and the quality of the available information – a fact which is not possible with the maintenance of analogical systems.

- **Stakeholders must be involved in the launch of new products –** Stakeholder should be involved in the specification and launching of the products, namely through the participation of associations and other representative organisations (such as the case of the association of the visually impaired in Coimbra, which helped plan and implement in the best possible fashion the audible information in the bus and bus stops).

- **Quality control and monitoring of the information provided to the public is very important –** Since the quality and reliability of the information are essential to the credibility of the information systems offered to the public it is indispensable to maintain a

rigorous and frequent control of the information offered. In the case of Coimbra, the access to the information was conducted through the GPS / GPRS Operation Support System control centre, including the replication of the information provided via the real-time information e-panels.

D.4.2 Recommendations: process

- **Despite the financial crisis alternative solutions must be find to overcome this problem –** The financial crisis in Portugal causes a lack of national funding for the major part of the large-scale investments in the CIVITAS measures and made SMTUC assume the financial compromises on its own. This fact delayed the rate of purchase of the new e-panels with real time information for passengers (namely in bus stops). But to avoid finishing the CIVITAS MODERN project without any purchase of e-panels, it was decided to buy in the first phase only 1 e-panel for the bus stops and 5 e-panels with the same functions but for interiors. This kind of e-panel is cheaper, but very useful as in the case of Coimbra which installed these e-panels in the lobbies and waiting rooms of hospitals.

- **Installation process of the system must be carefully monitored –** Supporting and monitoring the installation process at the early stages of the GPRS / GPS Operation Support System was very important for detecting and characterising the diverse problems that came up and to find rapid solutions for them.

ANNEX 1 Average Revenues Data

The next table shows the data obtained relative to operating revenue, passenger numbers and vechicle-km in SMTUC network:

Year	Operating Revenue (€)	Number of Passengers	Vehicle-km
2001	6.675.000,00	26.355.409	5.689.000
2002	6.730.000,00	26.815.583	5.954.000
2003	7.038.000,00	27.065.496	6.043.000
2004	7.148.000,00	27.621.417	6.053.000
2005	7.287.000,00	27.393.744	6.071.000
2006	7.590.000,00	27.145.712	6.089.000
2007	7.951.000,00	27.432.020	5.887.000
2008	8.148.000,00	27.689.418	5.806.000
2009	8.043.000,00	27.220.764	5.698.000
2010	7.797.000,00	26.937.520	5.924.000
2011	7.704.514,90	27.077.853	5.886.000

Source: SMTUC

The following table shows the data obtained related to passenger numbers in the urban PT of Braga (TUB) network:

Year	Number of passengers
2007	11.321.000
2008	11.292.000
2009	10.452.000
2010	10.275.000
2011	10.781.000

Source: TUB

ANNEX 2 Average Operating Costs Data

The following table shows the data obtained concerning the operating costs in the SMTUC network divided by four cost categories (Personnel Costs, Fuel Costs, Maintenance Costs and Other Operational Costs), obtained from SMTUC PT operator:

Year	Personnel Costs (€)	Fuel Costs (€)	Maintenance Costs (€)	Other Operational Costs (€)
2000	6.211.276,14	1.197.056,24	455.196,74	1.991.545,35
2001	6.667.741,24	1.333.845,61	520.198,97	2.373.431,80
2002	7.398.532,70	1.458.151,45	591.124,78	2.127.700,05
2003	7.441.994,83	1.561.723,50	606.400,18	2.503.095,84
2004	7.621.411,45	1.809.821,20	759.229,61	3.028.831,96
2005	7.913.630,41	2.192.124,07	762.153,41	2.895.859,05
2006	8.135.630,49	2.426.966,60	781.505,97	2.621.444,52
2007	8.369.273,36	2.476.741,77	784.174,64	2.541.586,80
2008	8.355.722,54	2.977.081,11	900.721,81	2.807.772,14
2009	8.982.836,77	2.261.365,92	955.504,79	2.974.657,30
2010	8.953.220,48	2.701.160,84	884.608,00	2.925.517,37
2011	8.586.244,59	3.144.380,01	898.442,65	2.822.488,84

Source: SMTUC

The folowing table shows the data obtained relative to the Total Operational Costs and Vechicle-km in SMTUC network, obtained from SMTUC PT operator:

Year	Total Operational Costs (€)	Vehicle-km
2000	9.855.074,47	5.571.000
2001	10.895.217,62	5.689.000
2002	11.575.508,98	5.954.000
2003	12.113.214,35	6.043.000
2004	13.219.294,22	6.053.000
2005	13.763.766,94	6.071.000
2006	13.965.547,58	6.089.000
2007	14.171.776,57	5.887.000
2008	15.041.297,60	5.806.000
2009	15.174.364,78	5.698.000
2010	15.464.506,69	5.924.000
2011	15.451.556,09	5.886.000

Source: SMTUC

The following table shows the data obtained relating to the management and information systems (i.e., directly related to the implementation of the measure) and from which the additional operating cost resulting from the implementation of the measure has been obtained over one year:

Operational Cost of the management and information systems	Old System	New System	Difference 2009
Personnel	116.587,15 €	127.604,60 €	11.017,45 €
Energy	4.339,94 €	4.829,96 €	490,02 €
Communication services	7.596,28 €	11.287,13 €	3.690,85 €
Maintenance personnel	10.712,37 €	19.258,42 €	8.546,05 €
Software maintenance	0,00 €	21.600,00 €	21.600,00 €
Hardware maintenance	40,28 €	170,17 €	129,89 €
Total	139.276,02 €	184.750,28 €	45.474,26 €

Source: SMTUC

The data collection has been carried out from 2007-03-01 to 2008-02-29 for the old system and from 2009-01-01 to 2009-12-31 for the new system

The additional operating cost resulting from the implementation of the measure for 2008, 2010 and 2011 has been determined on the basis of the value obtained for 2009.

The value for 2008 considers that the system only has been implemented from March onwards and the values for 2010 and 2011 consider the inflation rate of the previous year, given the fact that the contracts of supplying the necessary resources for the measure are defined according to the inflation rate of the previous year.

Operational Cost of the management and information systems	Difference 2008	Difference 2009	Difference 2010	Difference 2011
Personnel	9.181,21 €	11.017,45 €	10.929,31 €	11.082,32 €
Energy	408,35 €	490,02 €	486,10 €	492,91 €
Communication services	3.075,71 €	3.690,85 €	3.661,32 €	3.712,58 €
Maintenance personnel	7.121,71 €	8.546,05 €	8.477,68 €	8.596,37 €
Software maintenance	18.000,00 €	21.600,00 €	21.427,20 €	21.727,18 €
Hardware maintenance	108,24 €	129,89 €	128,85 €	130,65 €
Total	37.895,22 €	45.474,26 €	45.110,47 €	45.742,01 €

The next table shows the inflation rate from 2009-2010:

Year	2008	2009	2010	2011
Inflation Rate (%)	2,60%	-0,80%	1,40%	3,80%

Source: Bank of Portugal, National Institute of Statistics

ANNEX 3 Capital Costs Data

Year	Capital cost values(€)
2007	0,00
2008 (Investment in the purchase of the equipment3)	241.542,00
2009	0,00
2010	0,00
2011	0,00
Total	241.542,00

Source: SMTUC

ANNEX 4 Lost Trips Data

Data relative to lost trips during 2000, obtained from SMTUC PT operator:

VIAGENS PERDIDAS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-00	680	1	0	0	0	206	0	0	**887**
Fev-00	641	6	12	0	0	82	0	0	**741**
Mar-00	775	4	0	0	0	166	0	1171	**2116**
Abr-00	602	3	4	0	1	130	0	13	**753**
Mai-00	773	9	0	0	0	190	0	383	**1355**
Jun-00	738	9	0	0	32	350	0	0	**1129**
Jul-00	267	6	0	0	0	132	0	0	**405**
Ago-00	22	2	0	0	0	30	0	0	**54**
Set-00	425	15	15	0	1	645	0	0	**1101**
Out-00	719	18	1	0	9	424	4	0	**1175**
Nov-00	725	33	3	1	0	360	0	157	**1279**
Dez-00	766	12	11	14	1	389	1	0	**1194**

QUILOMETROS PERDIDOS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-00	6365	16	0	0	0	2026	0	0	**8407**
Fev-00	5576	85	90	0	0	822	0	0	**6573**
Mar-00	6815	70	0	0	0	1620	0	15675	**24180**
Abr-00	5063	33	31	0	9	1262	0	121	**6519**
Mai-00	6802	92	0	0	0	1911	0	4503	**13308**
Jun-00	6512	124	0	0	251	3128	0	0	**10015**
Jul-00	2713	102	0	0	0	1326	0	0	**4141**
Ago-00	199	17	0	0	0	484	0	0	**700**
Set-00	3889	143	118	0	13	5833	0	0	**9996**
Out-00	6406	196	9	0	91	3525	45	0	**10272**
Nov-00	7074	312	20	8	0	3002	0	1478	**11894**
Dez-00	7639	172	82	110	20	3387	12	0	**11422**

LEGENDA:

A	Não cumprimento de horário
B	Avaria na viatura
C	Avaria na rede de tracção ou falta de corrente
D	Interrupção de rua ou estrada
E	Acidente
F	Falta de motorista
G	Falta de viatura
H	Outros motivos

[3] The purchase of the necessary equipment for the management and information systems occurred in 2007-12-2007. However, considering that this purchase occurred only few days before the start of the year in which the operation started (which started during March 2008),on scope of this document, the capital costs related to the purchase of the necessary equipment for the management and information systems are accounted on year 2008.

Data concerning lost trips during 2001, obtained from SMTUC PT operator:

VIAGENS PERDIDAS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-01	1054	18	46	2	13	406		1	**1540**
Fev-01	840	6			43	398			**1287**
Mar-01	835	35			2	299		2448	**3619**
1.º Trim	2729	59	46	2	58	1103		2449	**6446**
Abr-01	546	13		1	1	200		82	**843**
Mai-01	836	13		7	29	609		2662	**4156**
Jun-01	754	2				619			**1375**
2.º Trim	2136	28		8	30	1428		2744	**6374**
Jul-01	658	7	6		6	349		47	**1073**
Ago-01	61	15			2	221			**299**
Set-01	624	29	10			449			**1112**
3.º Trim	1343	51	16		8	1019		47	**2484**
Out-01	1592	55	21	11	19	219	15	278	**2210**
Nov-01									
Dez-01									
4.º Trim	1592	55	21	11	19	219	15	278	**2210**
ANO	7800	193	83	21	115	3769	15	5518	17514

QUILOMETROS PERDIDOS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-01	10618	210	341	17	130	3578		10	**14904**
Fev-01	7860	58			339	3463			**11720**
Mar-01	7396	348			17	2579		33898	**44238**
1.º Trim	25874	616	341	17	486	9620		33908	**70862**
Abr-01	4697	115		12	28	1739		963	**7554**
Mai-01	7616	164		104	242	5445		35927	**49498**
Jun-01	6389	20				5567			**11976**
2.º Trim	18702	299		116	270	12751		36890	**69028**
Jul-01	5433	84	126		72	3116		611	**9442**
Ago-01	691	201			39	2218			**3149**
Set-01	5693	363	85			4272			**10413**
3.º Trim	11817	648	211		111	9606		611	**23004**
Out-01	15999	703	147	72	195	2208	184	3287	**22795**
Nov-01									
Dez-01									
4.º Trim	15999	703	147	72	195	2208	184	3287	**22795**
ANO	72392	2266	699	205	1062	34185	184	74696	185689

LEGENDA:

A	Não cumprimento de horário
B	Avaria na viatura
C	Avaria na rede de tracção ou falta de corrente
D	Interrupção de rua ou estrada
E	Acidente
F	Falta de motorista
G	Falta de viatura
H	Outros motivos

Data concerning lost trips during 2002, obtained from SMTUC PT operator:

VIAGENS PERDIDAS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-02	735	91	19	20	19	336	4	3	**1227**
Fev-02	480	52	3	4	8	195	0	6	**748**
Mar-02	451	67	16	19	12	59	3	4	**631**
	1666	**210**	**38**	**43**	**39**	**590**	**7**	**13**	
Abr-02	399	67	29	3	23	25	0	9	**555**
Mai-02	521	64	14	19	18	65	0	11	**712**
Jun-02	282	45	10	18	21	16	28	1	**421**
	1202	**176**	**53**	**40**	**62**	**106**	**28**	**21**	
Jul-02	59	39	2	4	17	116	0	0	**237**
Ago-02	37	25	0	7	6	1	0	0	**76**
Set-02	437	74	32	4	25	25	0	9	**606**
	533	**138**	**34**	**15**	**48**	**142**	**0**	**9**	
Out-02	605	68	8	6	21	1	0	329	**1038**
Nov-02	592	50	1	17	23	9	1	4	**697**
Dez-02	638	56	3	3	14	0	0	77	**791**
	1835	**174**	**12**	**26**	**58**	**10**	**1**	**410**	

QUILOMETROS PERDIDOS

MÊS	A	B	C	D	E	F	G	H	TOTAL
Jan-02	6454	937	113	161	173	3183	53	39	**11113**
Fev-02	5636	669	27	34	115	1683	0	58	**8222**
Mar-02	6368	1158	196	293	237	525	56	50	**8883**
Abr-02	6848	1484	361	62	511	264	0	163	**9693**
Mai-02	9828	1317	211	387	378	386	0	117	**12624**
Jun-02	6895	1016	184	501	438	135	235	8	**9412**
Jul-02	1446	1022	20	77	498	1111	0	0	**4174**
Ago-02	513	366	0	73	77	4	0	0	**1033**
Set-02	10331	2221	540	92	764	264	0	163	**14375**
Out-02	16937	1776	87	155	606	20	0	4536	**24117**
Nov-02	15109	1425	23	488	810	76	18	44	**17993**
Dez-02	6841	737	20	41	201	0	0	947	**8787**

LEGENDA:

A	Não cumprimento de horário
B	Avaria na viatura
C	Avaria na rede de tracção ou falta de corrente
D	Interrupção de rua ou estrada
E	Acidente
F	Falta de motorista
G	Falta de viatura
H	Outros motivos

Data concerning lost trips during 2007, obtained from SMTUC PT operator:

3120 - SES (Estatística)

VIAGENS PERDIDAS / 2007

MOTIVOS

	Não cumprimento de horário	Avaria na viatura	Avaria na rede de tracção/falta corrente	Interrupção de rua ou estrada	Acidente	Falta de motorista	Falta de viatura	Outros motivos	
	A	B	C	D	E	F	G	H	TOTAL / Mês
JAN	45	29	2	11	10	0	2	2	**101**
FEV	54	43	6	4	15	0	1	3	**126**
MAR	163	52	7	8	15	0	0	5	**250**
ABR	118	57	3	4	5	0	3	10	**200**
MAI	73	56	25	6	20	0	4	13	**197**
JUN	112	36	2	4	8	4	0	23	**189**
JUL	34	37	2	8	8	1	0	1	**91**
AGO	13	32	0	0	2	1	0	1	**49**
SET	60	61	1	1	6	0	0	4	**133**
OUT	113	62	6	4	13	0	0	7	**205**
NOV	135	42	0	7	8	0	0	5	**197**
DEZ	142	24	8	3	25	0	0	3	**205**
Total /									1.943
Motivo	**1.062**	**531**	**62**	**60**	**135**	**6**	**10**	**77**	

Data concerning lost trips during 2008, obtained from SMTUC PT operator:

3120 - SES (Estatística)

VIAGENS PERDIDAS / 2008

MOTIVOS

	Não cumprimento de horário	Avaria na viatura	Avaria na rede de tracção/falta corrente	Interrupção de rua ou estrada	Acidente	Falta de motorista	Falta de viatura	Outros motivos	
	A	B	C	D	E	F	G	H	TOTAL / Mês
JAN	44	60	9	11	7	0	0	11	**142**
FEV	17	45	6	1	8	1	0	8	**86**
MAR	19	32	14	0	6	0	0	4	**75**
ABR	83	51	5	14	9	0	0	19	**181**
MAI	64	50	4	27	5	1	3	9	**163**
JUN	37	64	15	7	13	0	1	2	**139**
JUL	41	44	0	0	2	0	1	4	**92**
AGO	3	16	0	0	3	0	0	3	**25**
SET	43	56	3	4	8	0	0	4	**118**
OUT	125	70	7	25	13	0	0	7	**247**
NOV	136	41	6	8	7	0	0	3	**201**
DEZ	177	48	10	2	10	2	0	0	**249**
Total /									1.718
Motivo	**789**	**577**	**79**	**99**	**91**	**4**	**5**	**74**	

Data concerning lost trips during 2009, obtained from SMTUC PT operator:

3120 - SES (Estatística)

VIAGENS PERDIDAS / 2009

MOTIVOS

	Não cumprimento de horário	Avaria na viatura	Avaria na rede de tracção/falta corrente	Interrupção de rua ou estrada	Acidente	Falta de motorista	Falta de viatura	Outros motivos	
	A	B	C	D	E	F	G	H	TOTAL / Mês
JAN	40	59	5	1	6	0	4	4	**119**
FEV	45	81	0	3	7	0	0	4	**140**
MAR	47	55	1	0	3	0	0	8	**114**
ABR	66	58	4	33	6	0	0	6	**173**
MAI	44	118	7	50	3	0	0	2	**224**
JUN	16	59	3	2	7	0	0	5	**92**
JUL	7	29	2	3	8	0	1	1	**51**
AGO	6	23	0	0	6	0	0	1	**36**
SET	29	55	0	0	6	0	0	2	**92**
OUT	157	74	1	4	10	1	0	15	**262**
NOV	91	66	0	13	12	5	0	6	**193**
DEZ	33	33	1	16	8	0	1	2	**94**
Total / Motivo	**581**	**710**	**24**	**125**	**82**	**6**	**6**	**56**	1.590

Data concerning lost trips during 2010, obtained from SMTUC PT operator:

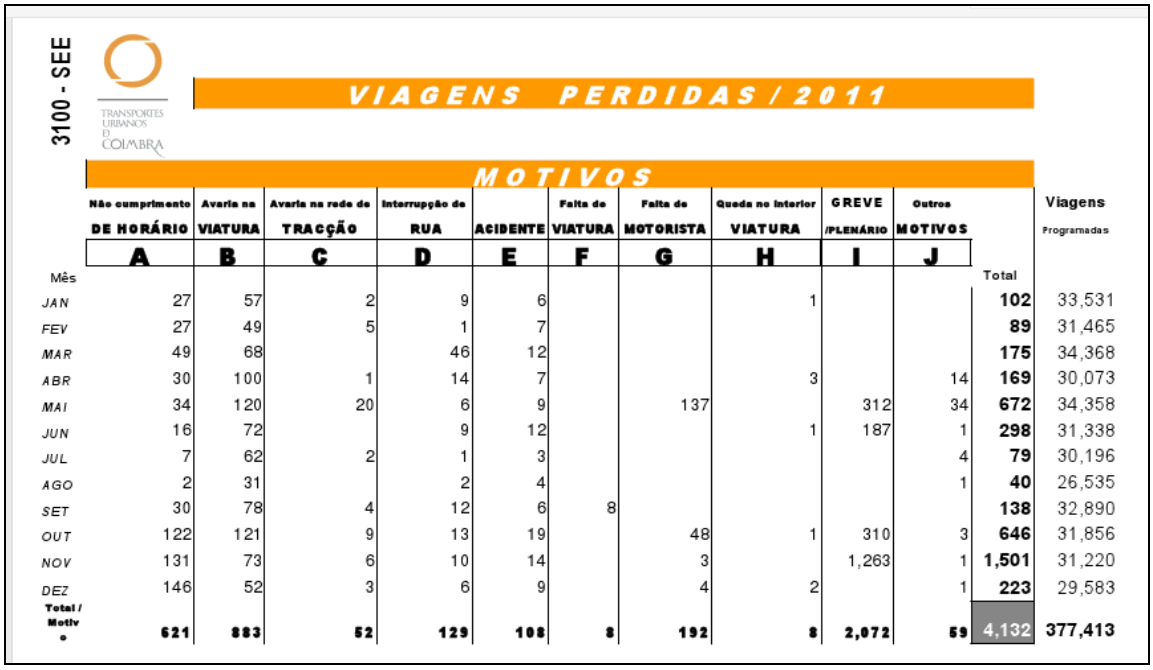
3100 - SEE

VIAGENS PERDIDAS / 2010

MOTIVOS

Mês	Não cumprimento DE HORÁRIO	Avaria na VIATURA	Avaria na rede de TRACÇÃO	Interrupção de RUA	ACIDENTE	Falta de VIATURA	Falta de MOTORISTA	Queda no interior VIATURA	Outros MOTIVOS	Total /Mês
	A	B	C	D	E	F	G	H	I	
JAN	52	71	13	18	12	0	1	0	0	**167**
FEV	49	49	1	7	10	2	0	0	2	**120**
MAR	60	68	4	32	16	0	0	0	20	**200**
ABR	24	84	15	13	11	0	0	1	5	**153**
MAI	77	117	5	3	12	0	0	0	8	**222**
JUN	8	70	3	7	8	0	1	0	2	**99**
JUL	35	75	5	29	6	0	0	0	2	**152**
AGO	5	19	0	2	2	0	0	0	0	**28**
SET	40	34	4	11	4	0	0	1	4	**98**
OUT	375	93	1	39	8	0	0	1	0	**517**
NOV	79	55	10	17	14	0	1	2	1	**179**
DEZ	60	71	1	22	17	0	0	3	0	**174**
Total / Motivo	**864**	**806**	**62**	**200**	**120**	**2**	**3**	**8**	**44**	2.109

Data concerning lost trips during 2011, obtained from SMTUC PT operator:



3100 - SEE

TRANSPORTES URBANOS DE COIMBRA

VIAGENS PERDIDAS / 2011

MOTIVOS

Mês	Não cumprimento DE HORÁRIO A	Avaria na VIATURA B	Avaria na rede de TRACÇÃO C	Interrupção de RUA D	ACIDENTE E	Falta de VIATURA F	Falta de MOTORISTA G	Queda no interior VIATURA H	GREVE /PLENÁRIO I	Outros MOTIVOS J	Total	Viagens Programadas
JAN	27	57	2	9	6			1			**102**	33,531
FEV	27	49	5	1	7						**89**	31,465
MAR	49	68		46	12						**175**	34,368
ABR	30	100	1	14	7			3		14	**169**	30,073
MAI	34	120	20	6	9		137		312	34	**672**	34,358
JUN	16	72		9	12			1	187	1	**298**	31,338
JUL	7	62	2	1	3					4	**79**	30,196
AGO	2	31		2	4					1	**40**	26,535
SET	30	78	4	12	6	8					**138**	32,890
OUT	122	121	9	13	19		48	1	310	3	**646**	31,856
NOV	131	73	6	10	14		3		1,263	1	**1,501**	31,220
DEZ	146	52	3	6	9		4	2		1	**223**	29,583
Total / Motivo	**621**	**883**	**52**	**129**	**108**	**8**	**192**	**8**	**2,072**	**59**	4,132	**377,413**

Synthesis of the total scheduled trips, of the total trips lost due to traffic problems, and determination of the percentage of trips lost due to traffic problems:

Year	2000	2001	2002	2007	2008	2009	2010	2011
Total scheduled trips	313.061	313.061	384.794	382.232	383.244	370.891	382.160	377.413
Total trips lost due to traffic problems	7.133	7.800	5.236	1.062	1.062	789	581	864
Trips lost due to traffic problems (%)	2,28	2,49	1,36	0,28	0,28	0,21	0,15	0,23

Source: SMTUC

ANNEX 5 Average Network Speed data

The following table shows the data obtained concerning the Average Network Speed in the SMTUC network obtained from SMTUC PT operator, obtained from SMTUC PT operator:

Year	Average Network Speed (km/h)
2001	16,5
2002	16,9
2003	16,5
2004	16,6
2005	16,4
2006	16,7
2007	16,8
2008	17,0
2009	17,0
2010	17,1
2011	17,1

Source: SMTUC

ANNEX 6 Awareness data

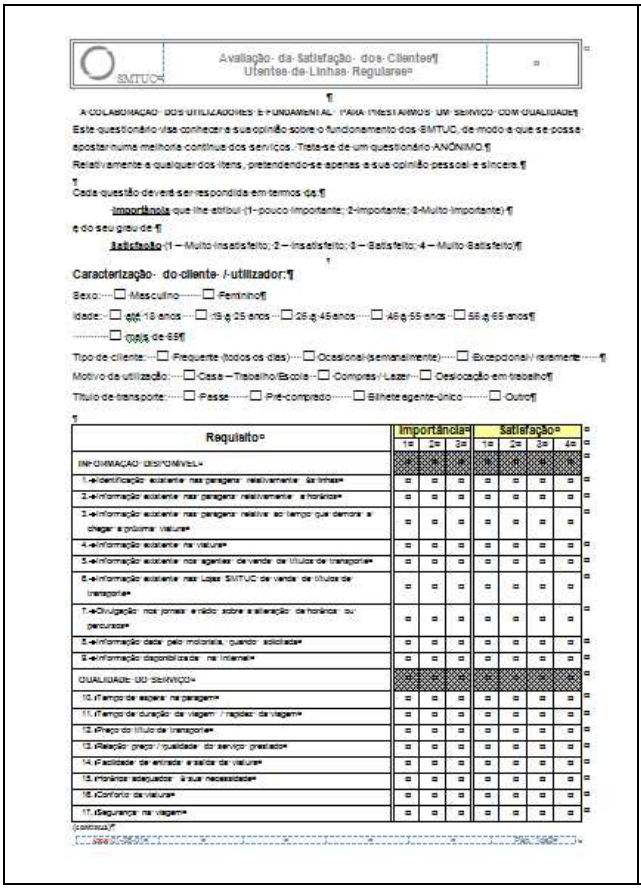
Question: Are you aware about the SMTUC timetable information service for mobile phones?

Year of the survey (period of data collection)	Positive answers – Yes (Nr.)	Negative answers – No (Nr).	Positive answers – Yes (%)
2009 (2008-12-04 a 2009-01-09)	0	0	0
2010 (2010-03-23 a 2010-03-29)	192	532	27
2011 (2011-03-29 a 2011-04-04)	250	482	34

Source: SMTUC

ANNEX 7 Quality Survey

ANNEX 7.1 Questionnaire model



Avaliação da Satisfação dos Clientes
Utentes de Linhas Regulares

A COLABORAÇÃO DOS UTILIZADORES É FUNDAMENTAL PARA PODERMOS OFERECER UM SERVIÇO COM QUALIDADE

Este questionário visa conhecer a sua opinião sobre o funcionamento dos SMTUC, de modo a que se possa apostar numa melhoria contínua dos serviços. Trata-se de um questionário ANÓNIMO.

Relativamente a qualquer dos itens, pretendendo-se apenas a sua opinião pessoal e sincera.

Cada questão deverá ser respondida em termos de:

Importância que lhe atribui (1- pouco importante; 2-importante; 3-Muito importante)

e do seu grau de

Satisfação (1 – Muito insatisfeito; 2 – Insatisfeito; 3 – Satisfeito; 4 – Muito Satisfeito)

Caracterização do cliente / utilizador:

Sexo: ☐ Masculino ☐ Feminino

Idade: ☐ até 18 anos ☐ 19 a 25 anos ☐ 26 a 45 anos ☐ 46 a 55 anos ☐ 56 a 65 anos ☐ com + de 65

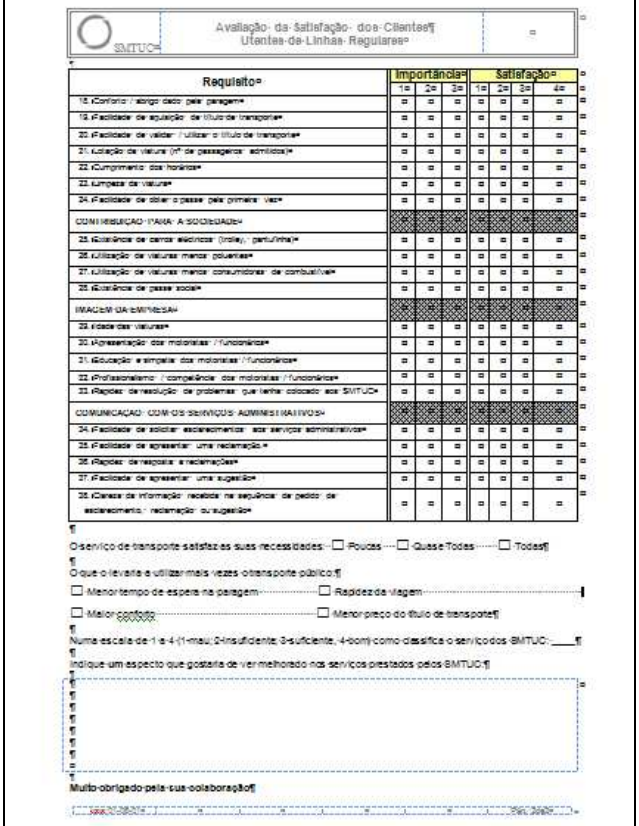
Tipo de cliente: ☐ Frequente (todos os dias) ☐ Ocasional (semanalmente) ☐ Excepcional / raramente

Motivo da utilização: ☐ Casa – Trabalho/Escola ☐ Compras / Lazer ☐ Deslocação em trabalho

Título de transporte: ☐ Passe ☐ Pré-comprado ☐ Bilhete agente-único ☐ Outro

Requisito	Importância			Satisfação			
	1	2	3	1	2	3	4
INFORMAÇÃO DISPONÍVEL							
1. Identificação existente nas paragens relativamente às linhas	☐	☐	☐	☐	☐	☐	☐
2. Informação existente nas paragens relativamente a horários	☐	☐	☐	☐	☐	☐	☐
3. Informação existente nas paragens relativa ao tempo que demora a chegar a próxima viatura	☐	☐	☐	☐	☐	☐	☐
4. Informação existente na viatura	☐	☐	☐	☐	☐	☐	☐
5. Informação existente nos agentes de venda de títulos de transporte	☐	☐	☐	☐	☐	☐	☐
6. Informação existente nas Lojas SMTUC de venda de títulos de transporte	☐	☐	☐	☐	☐	☐	☐
7. Divulgação nos jornais e rádio sobre a alteração de horários ou percursos	☐	☐	☐	☐	☐	☐	☐
8. Informação dada pelo motorista, quando solicitada	☐	☐	☐	☐	☐	☐	☐
9. Informação disponibilizada na Internet	☐	☐	☐	☐	☐	☐	☐
QUALIDADE DO SERVIÇO							
10. Tempo de espera na paragem	☐	☐	☐	☐	☐	☐	☐
11. Tempo de duração da viagem / rapidez da viagem	☐	☐	☐	☐	☐	☐	☐
12. Preço do título de transporte	☐	☐	☐	☐	☐	☐	☐
13. Relação preço / qualidade do serviço prestado	☐	☐	☐	☐	☐	☐	☐
14. Facilidade de entrada e saída da viatura	☐	☐	☐	☐	☐	☐	☐
15. Horários adequados à sua necessidade	☐	☐	☐	☐	☐	☐	☐
16. Conforto da viatura	☐	☐	☐	☐	☐	☐	☐
17. Segurança na viagem	☐	☐	☐	☐	☐	☐	☐

(continua)



Avaliação da Satisfação dos Clientes
Utentes de Linhas Regulares

Requisito	Importância			Satisfação			
	1	2	3	1	2	3	4
18. Conforto / abrigo dado pela paragem	☐	☐	☐	☐	☐	☐	☐
19. Facilidade de aquisição de título de transporte	☐	☐	☐	☐	☐	☐	☐
20. Facilidade de validar / utilizar o título de transporte	☐	☐	☐	☐	☐	☐	☐
21. Lotação da viatura (nº de passageiros admitidos)	☐	☐	☐	☐	☐	☐	☐
22. Cumprimento dos horários	☐	☐	☐	☐	☐	☐	☐
23. Limpeza da viatura	☐	☐	☐	☐	☐	☐	☐
24. Facilidade de obter o passe pela primeira vez	☐	☐	☐	☐	☐	☐	☐
CONTRIBUIÇÃO PARA A SOCIEDADE							
25. Existência de carros eléctricos (trolley, pantufinha)	☐	☐	☐	☐	☐	☐	☐
26. Utilização de viaturas menos poluentes	☐	☐	☐	☐	☐	☐	☐
27. Utilização de viaturas menos consumidoras de combustível	☐	☐	☐	☐	☐	☐	☐
28. Existência de passe social	☐	☐	☐	☐	☐	☐	☐
IMAGEM DA EMPRESA							
29. Idade das viaturas	☐	☐	☐	☐	☐	☐	☐
30. Apresentação dos motoristas / funcionários	☐	☐	☐	☐	☐	☐	☐
31. Educação e simpatia dos motoristas / funcionários	☐	☐	☐	☐	☐	☐	☐
32. Profissionalismo / competência dos motoristas / funcionários	☐	☐	☐	☐	☐	☐	☐
33. Rapidez de resolução de problemas que tenha colocado aos SMTUC	☐	☐	☐	☐	☐	☐	☐
COMUNICAÇÃO COM OS SERVIÇOS ADMINISTRATIVOS							
34. Facilidade de solicitar esclarecimentos aos serviços administrativos	☐	☐	☐	☐	☐	☐	☐
35. Facilidade de apresentar uma reclamação	☐	☐	☐	☐	☐	☐	☐
36. Rapidez de resposta a reclamações	☐	☐	☐	☐	☐	☐	☐
37. Facilidade de apresentar uma sugestão	☐	☐	☐	☐	☐	☐	☐
38. Clareza da informação recebida na sequência de pedido de esclarecimento / reclamação ou sugestão	☐	☐	☐	☐	☐	☐	☐

O serviço de transporte satisfaz as suas necessidades: ☐ Poucas ☐ Quase Todas ☐ Todas

O que o levaria a utilizar mais vezes o transporte público?

☐ Menor tempo de espera na paragem ☐ Rapidez da viagem

☐ Maior conforto ☐ Menor preço do título de transporte

Numa escala de 1 a 4 (1-mau; 2-insuficiente; 3-suficiente; 4-bom) como classifica o serviço dos SMTUC: ____

Indique um aspecto que gostaria de ver melhorado nos serviços prestados pelos SMTUC

Muito obrigado pela sua colaboração

ANNEX 7.2 Structure and questions

The questionnaire starts with 4 questions related to the interviewee – Sex, Age (<18, 19-25, 26-45, 56-65, >65), type of client (frequent, occasional, exceptional/rare use), motive of the trip (home-work/school, shopping/leisure, in service), and type of ticket (pass, single ticket bought on the selling point, single ticket bought on the vehicle, other).

The main part of the questionnaire is composed of 38 specific questions related to various items related to 5 areas of the service (1-Available information, 2-Quality of service, 3-Contribution to society, 4-Image of the company, 5-Communication with the administrative services) and a specific global customer satisfaction question that summerises the quality of service. In each question the people interviewed express a judgement choosing between very satisfied – satisfied – unsatisfied – very unsatisfied and about the importance of each of the 38 items choosing between very important – important – low importance.

Each question is assessed in terms of the importance given (1-Not important, 2-Important, 3-Very Important) and level of satisfaction (1-Very Dissatisfied 2-Dissatisfied 3-Satisfied 4-Very Satisfied) of the user concerning the respective item.

AVAILABLE INFORMATION
1. Identification of existing lines at stops
2. Information at stops about timetables
3. Information at stops about the waiting time until the next vehicle
4. Information inside the vehicle
5. Information at ticket selling points
6. Information at SMTUC ticket selling shops
7. Disclosure of information in the newspapers and radio about timetable or routes changing[4]
8. Information given by the driver, upon request
9. Information available on the Internet
QUALITY OF SERVICE
10. Waiting time at stop
11. Trip duration / speed of travel
12. Price of the ticket
13. Relation Price / Quality of the service
14. Ease of entry and exit of the vehicle
15. Adjustment of the timetable to your needs
16. Comfort of the vehicle
17. Safety during the trip
18. Comfort / protection given by the stop shelter
19. Ease of ticket purchase
20. Ease of ticket validation / utilization
21. Capacity of the vehicle (nr. of passengers allowed)
22. Compliance with the timetable
23. Cleanliness of the vehicle
24. Facility in obtaining the travelcard for the first time
CONTRIBUTION TO SOCIETY
25. Existence of electric vehicles (trolleybuses, electric mini-buses)

[4] This question was eliminated on the 2010 and 2011 surveys.

26. Utilization of less polluting vehicles
27. Utilization of less fuel consumming vehicles
28. Existence of social travelcard
IMAGE OF THE COMPANY
29. Age of the vehicles
30. Presentation of drivers / staff
31. Education and friendliness of the drivers / staff
32. Quality of driving performance of SMTUC drivers[5]
33. Professionalism / competence of the drivers / staff
34. Quickness in the resolution of problems you may have submited to SMTUC
COMMUNICATION WITH THE ADMINISTRATIVE SERVICES
35. Facility in requesting clarifications to the administrative services
36. Facility in submmiting a complaint.
37. Response quickness in respect to complaints
38. Facility in presenting a suggestion
39. Clarity of the information obtained in response to a request for information, complaint or suggestion

The questionnaire concludes with 5 questions related to the respondent's general attitude towards the service supplied by SMTUC:

1. The transportation service meets your needs (1-Few, 2-Nearly all, 3-All)

2. What would make you consider using public transportation more often (1-Shorter waiting time at stops, 2-Higher speeds, 3-Increased comfort, 4-Lower price of the ticket)

3. How do you rate the SMTUC service on a scale of 1 to 4 (1-bad, 2-poor, 3-sufficient, 4-good)

4. Indicate a point you would like to see improved in the SMTUC service:

[5] This question was not included on the 2009 survey.

ANNEX 7.3 Customer satisfaction survey results

Quality of service is measured by means of a customer satisfaction survey periodically carried out by SMTUC:

The survey is repeated once a year and is carried out to customers in face to face interviews on board of the SMTUC busses.

The sample is selected on the basis of the lines used by the passengers, i.e., the number of interviwees choosen in each line is defined according to the demand of the line in relation to the overall SMTUC demand.

The size of the sample is defined according to the specifications of the quality management auditors which supervise the entire process in line with the ISO9001 standard.

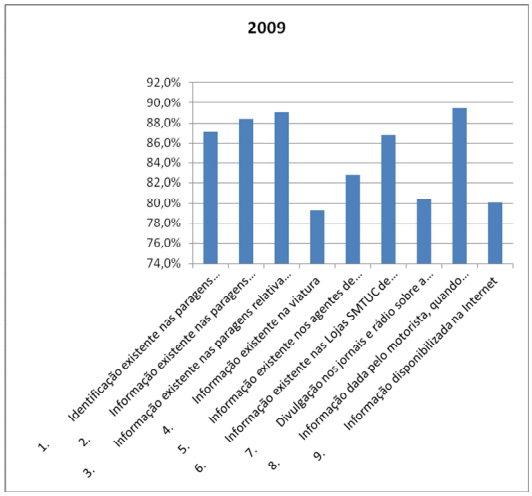
The quality management auditors considered 500 interviews as (a minimum) suitable to assess the quality evaluation by PT passengers in Coimbra. However, SMTUC voluntered to surpass this number. Thus, the following number of interviews and valid answers were achieved:

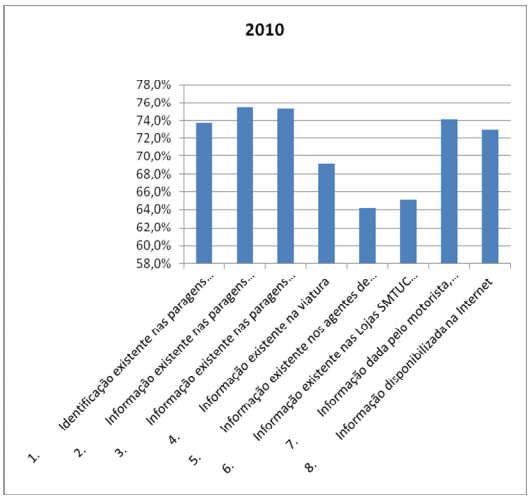
In 2009 a sample of 1000 interviews was defined and 984 valid answers were obtained.

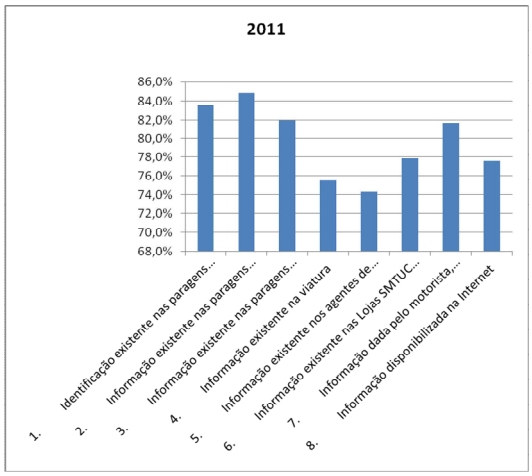
In 2010 a sample of 750 interviews was defined and 734 valid answers were obtained

In 2011 a sample of 750 interviews was defined and 736 valid answers were obtained

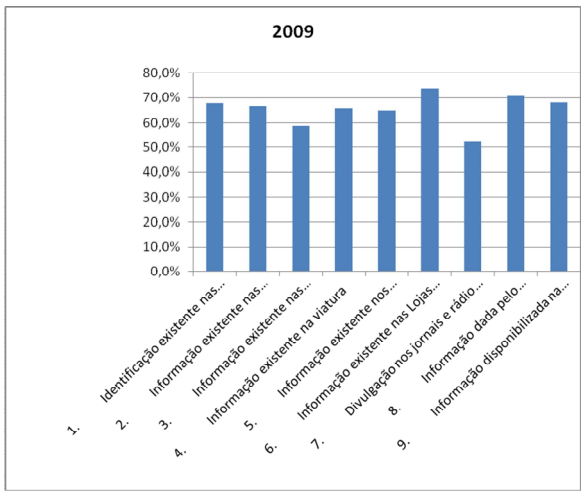
Importance given to the Available Information

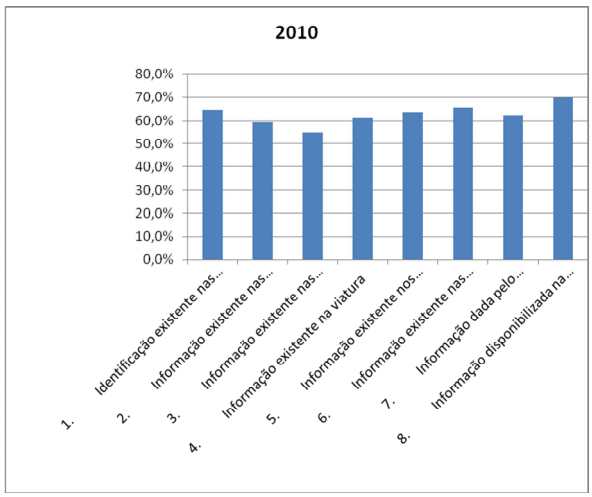


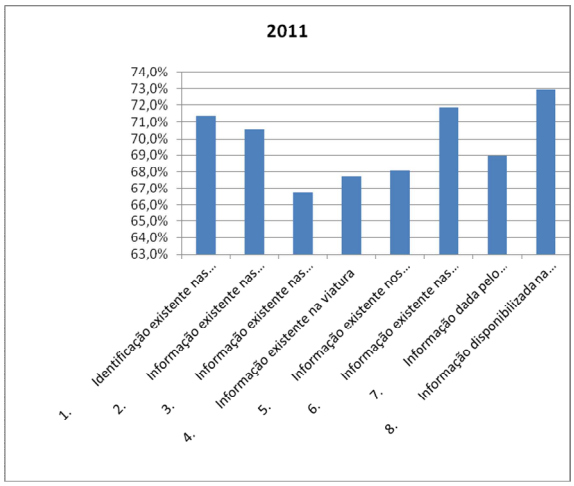


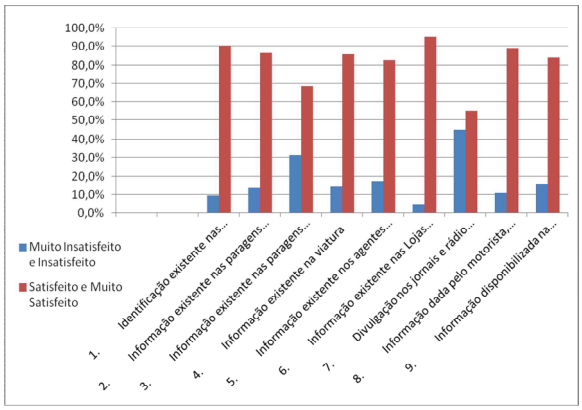


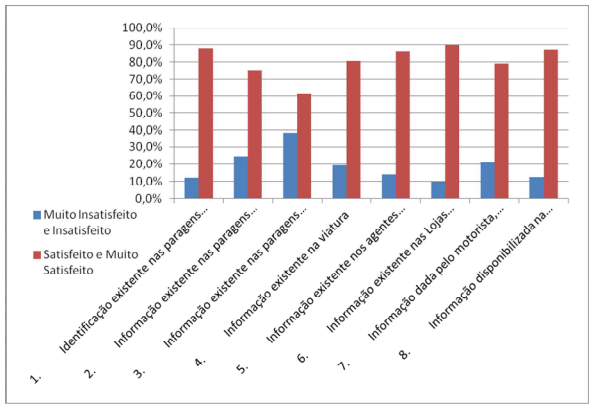
Level of satisfaction in accordance with the Available Information

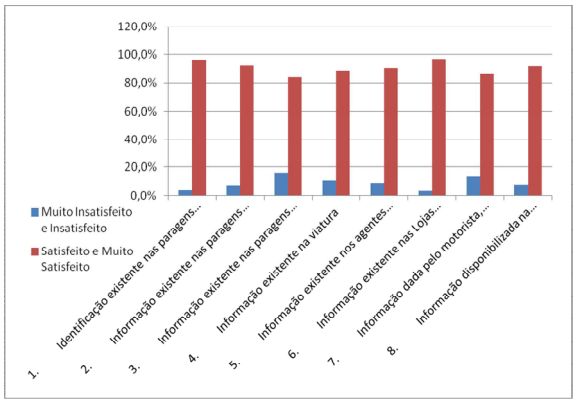




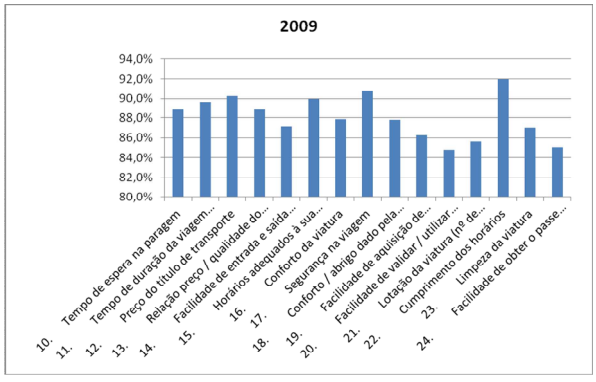


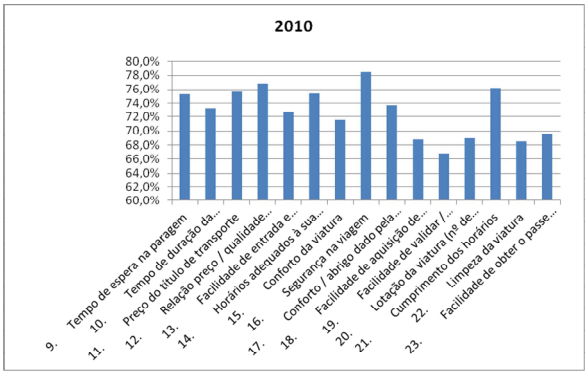


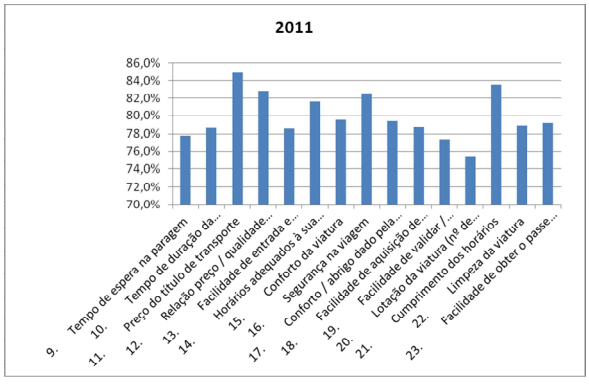




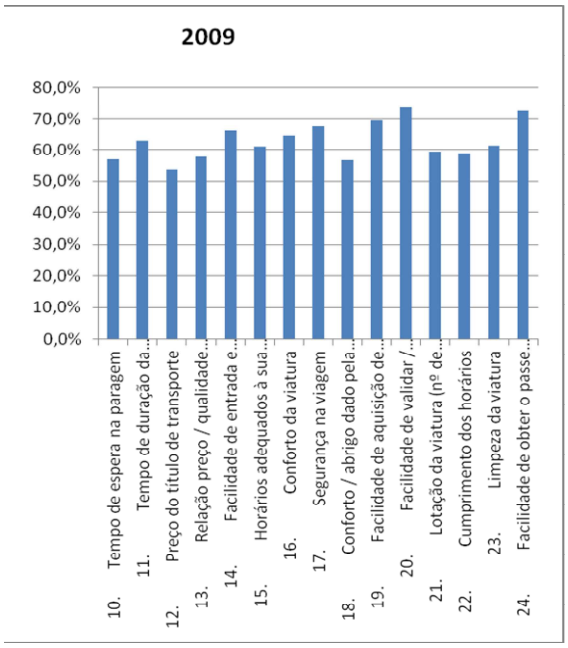
Importance given to the Quality of Service

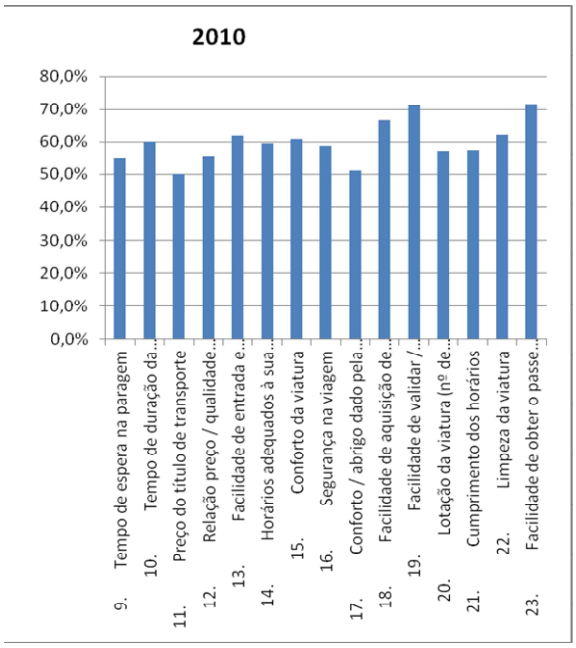


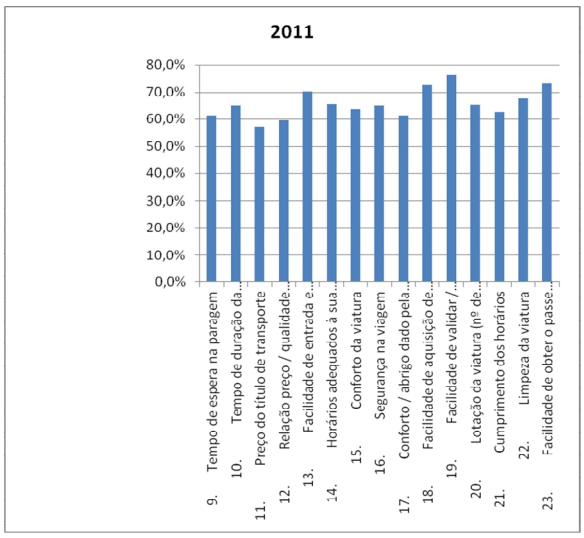


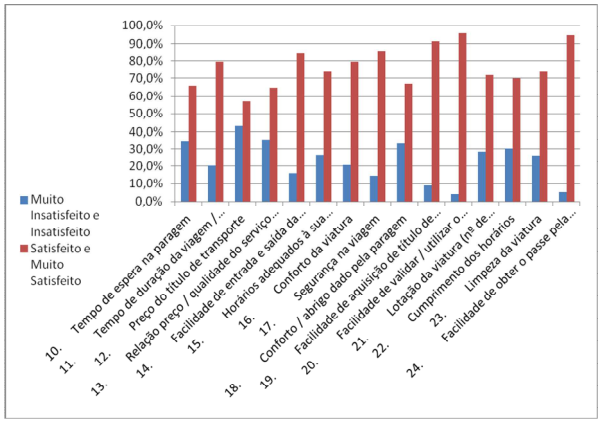


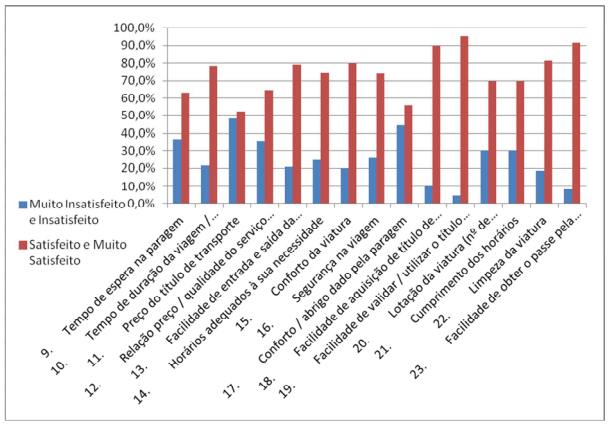
Level of satisfaction concerning the Quality of Service

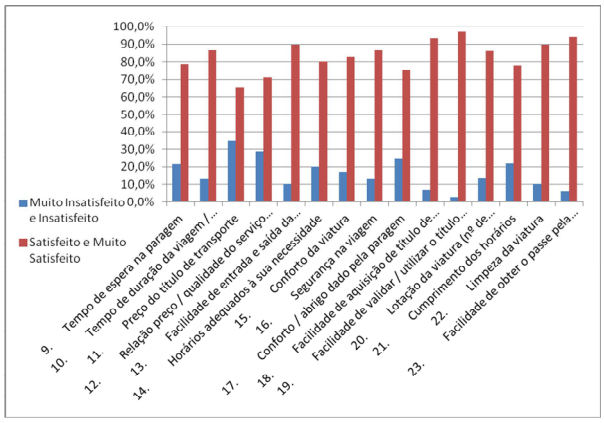




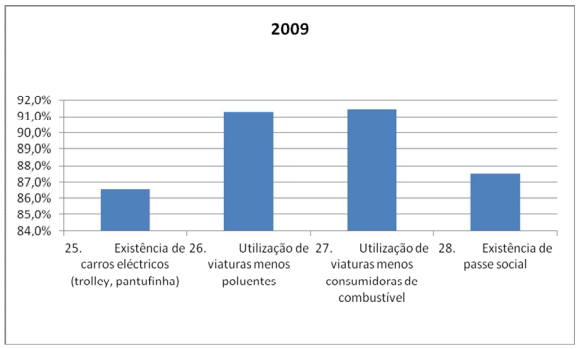


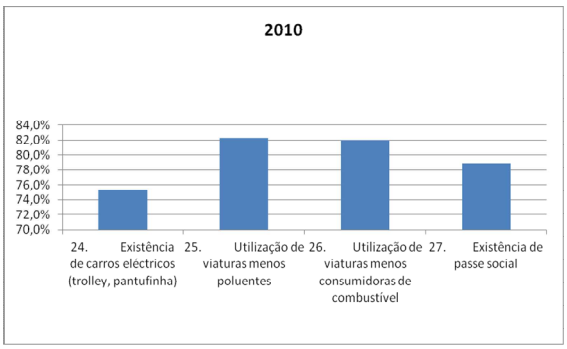


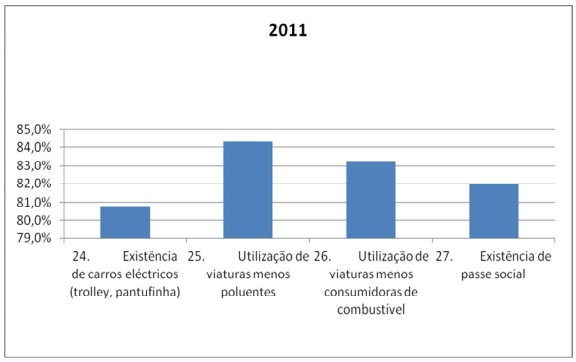




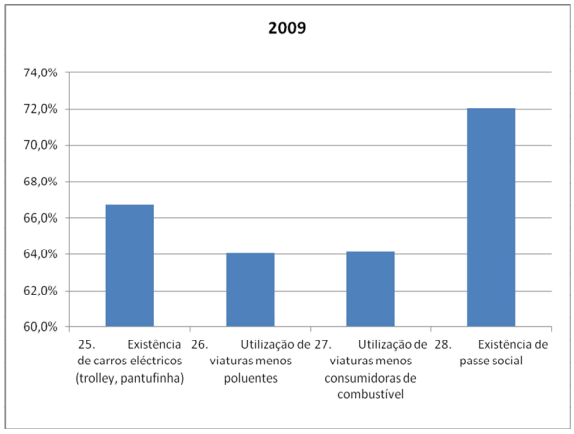
Importance given to the Contribution to Society

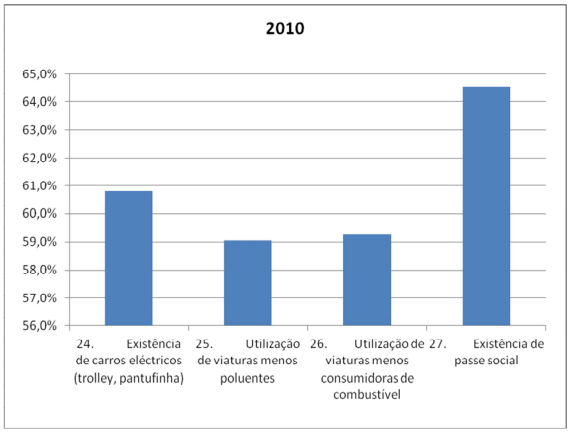


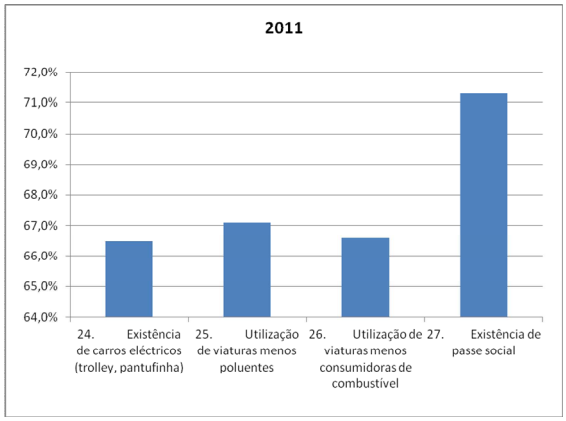


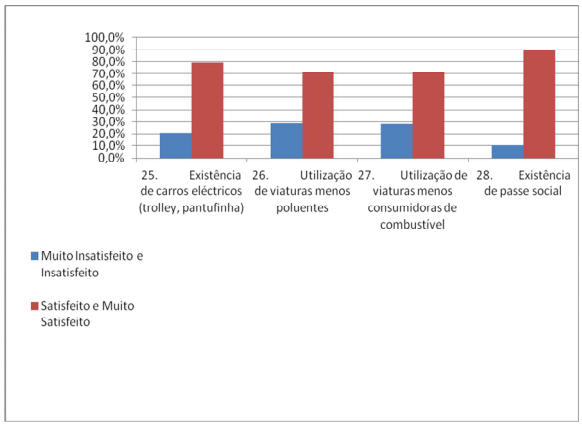


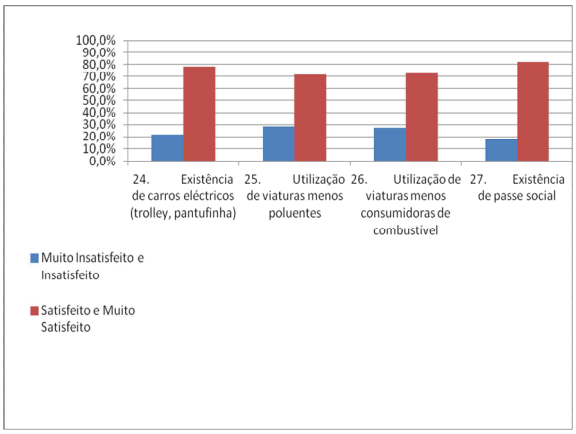
Level of satisfaction in relation to the Contribution to Society

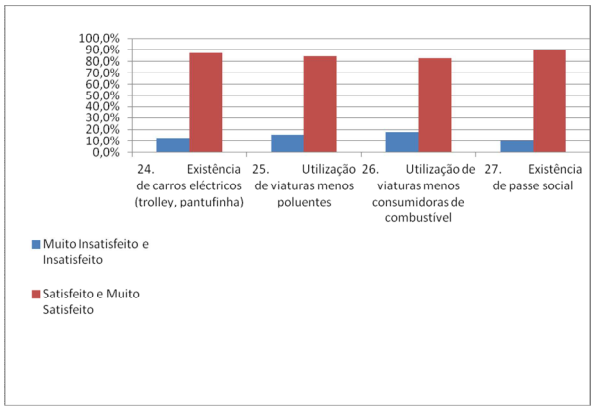




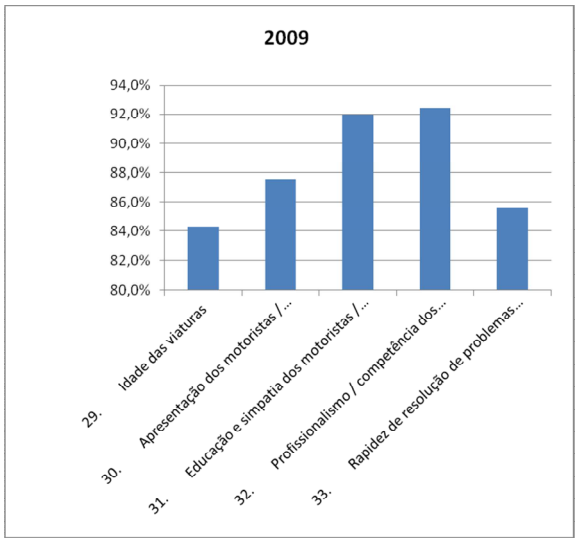


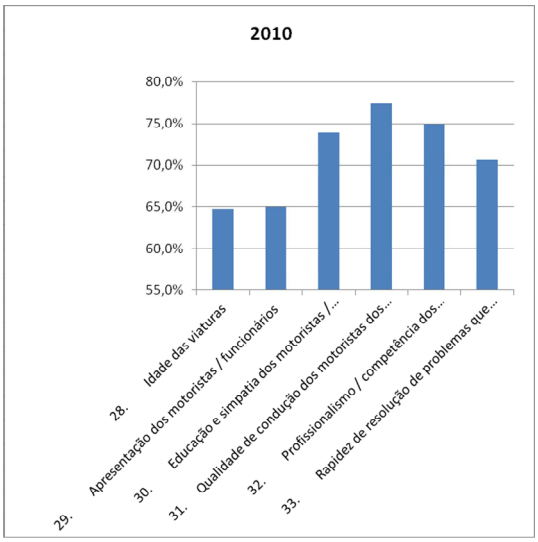


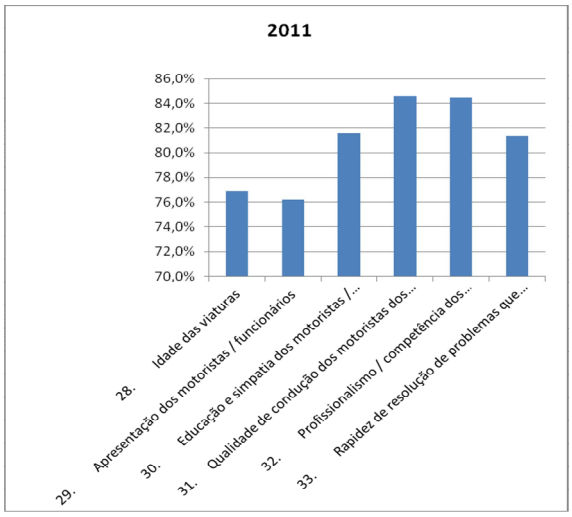




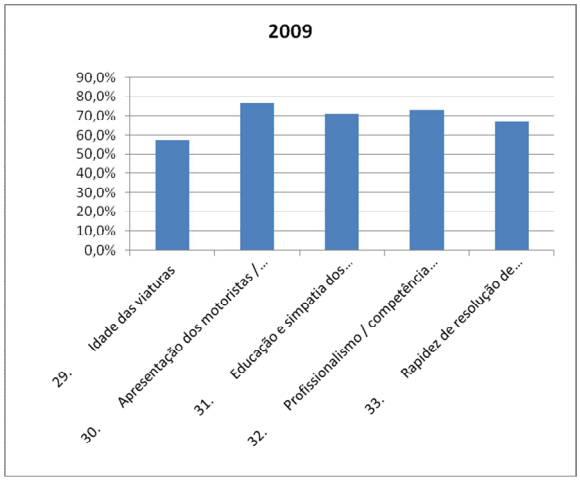
Importance given to the Image of the Company

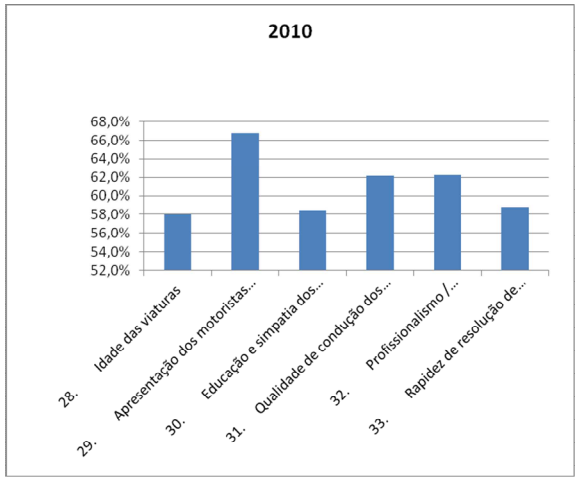


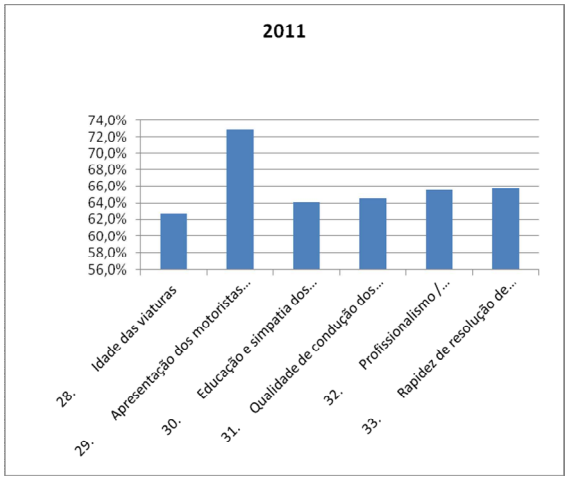


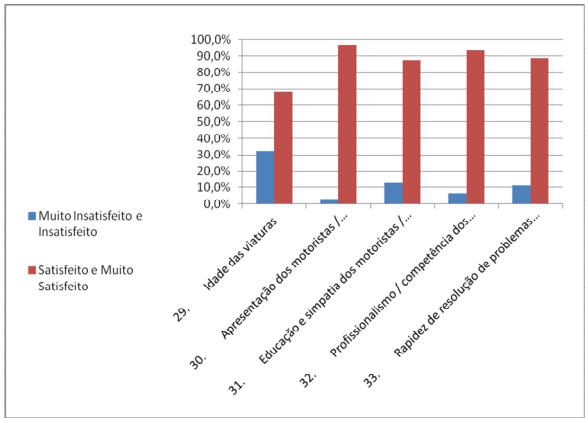


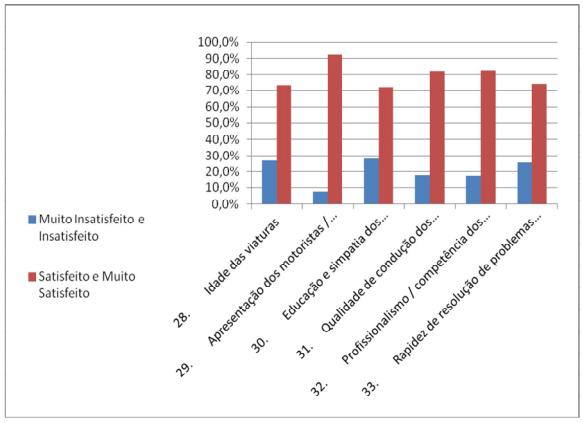
Level of satisfaction concerning the Image of the Company

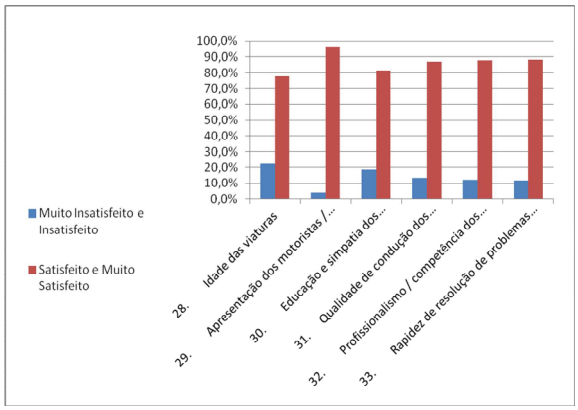




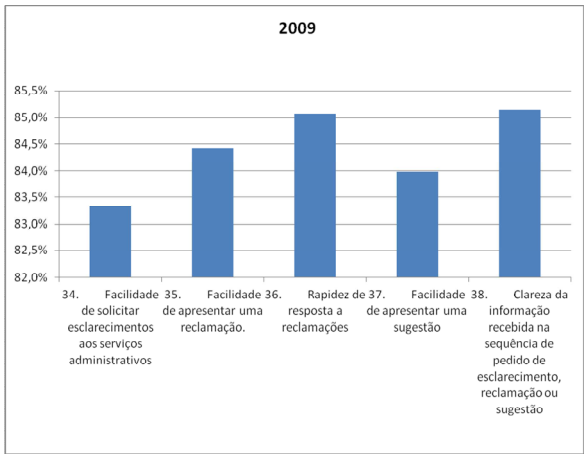


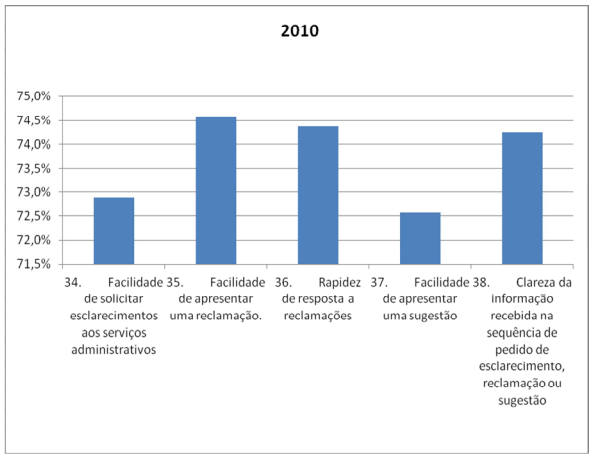


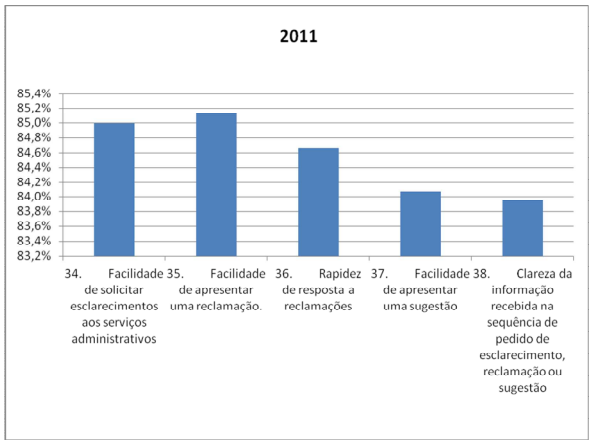




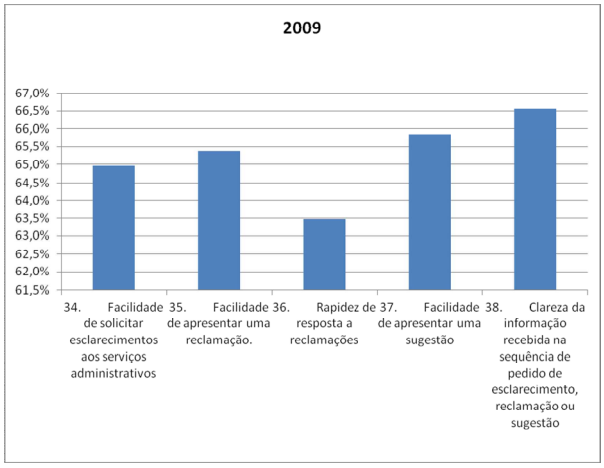
Importance given to the Communication with the Administrative Sevices

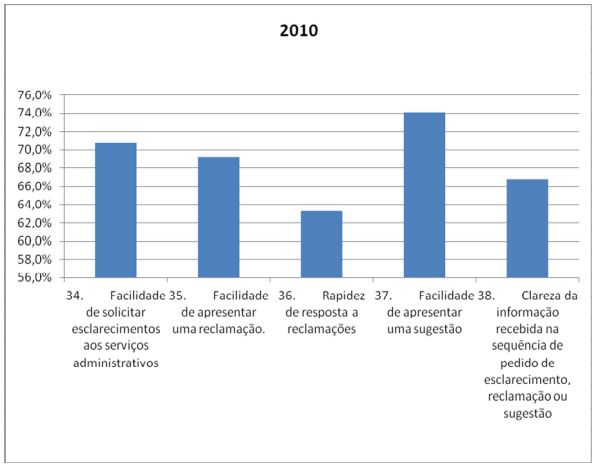


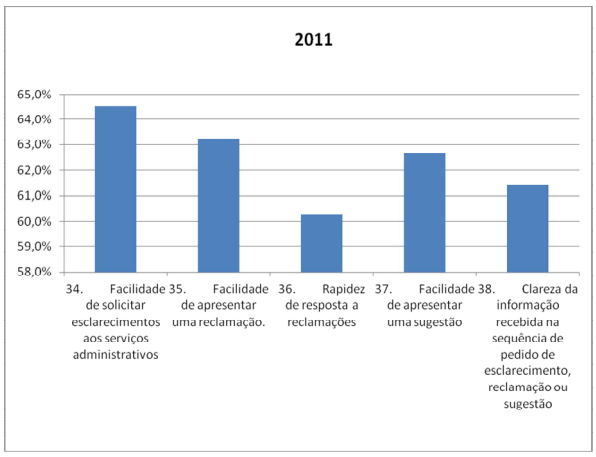


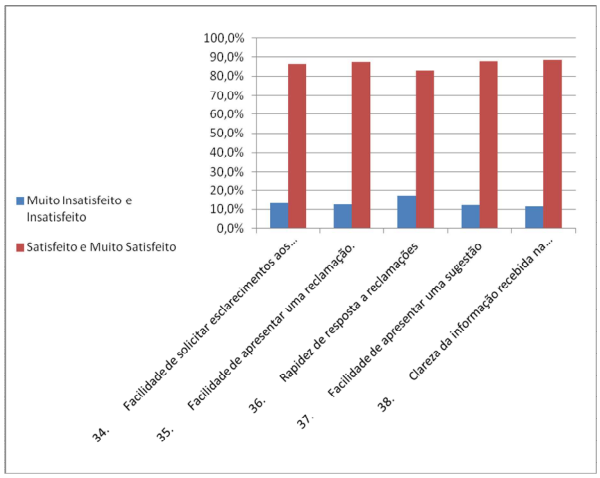


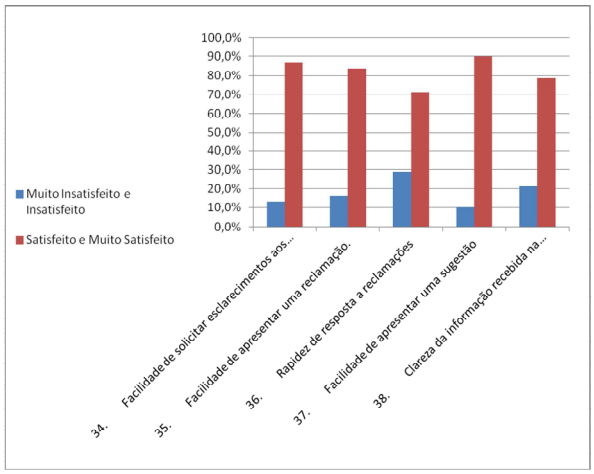
Level of satisfaction concerning the Communication with the Administrative Sevices

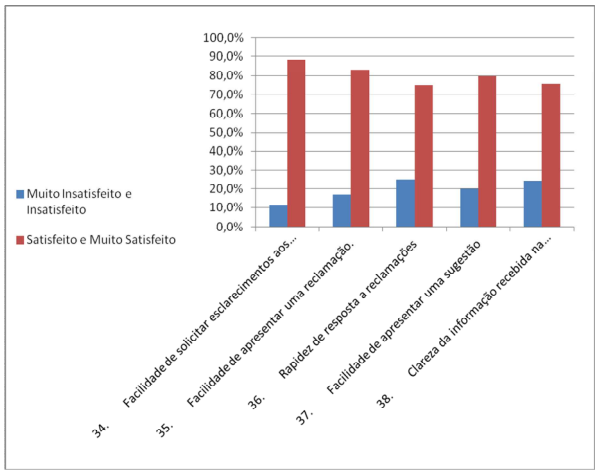






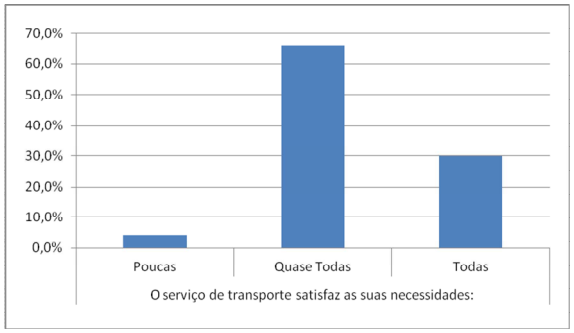




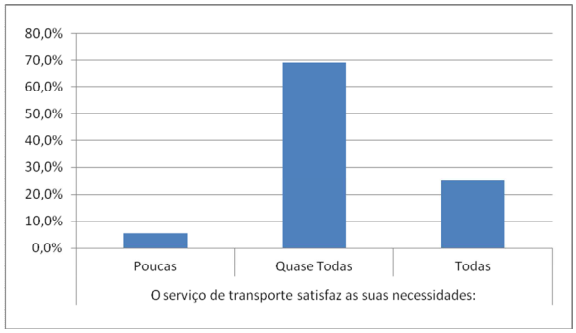


Results of the question "The transportation service meets your needs?"

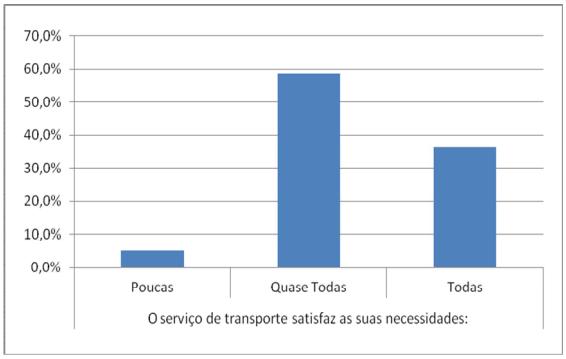
2009



2010

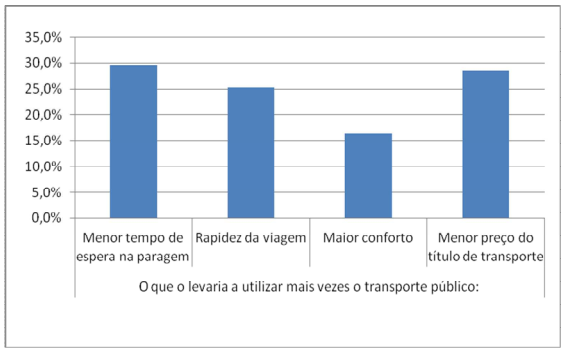


2011

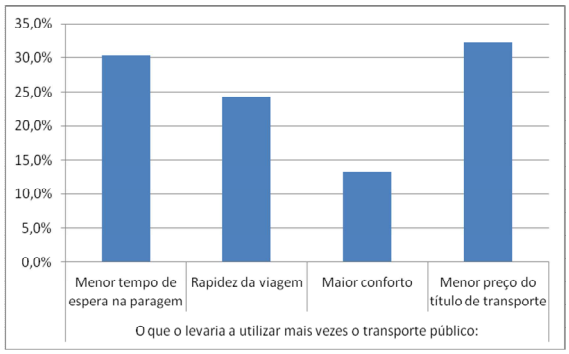


Results of the question "What would make you consider using public transportation more often?"

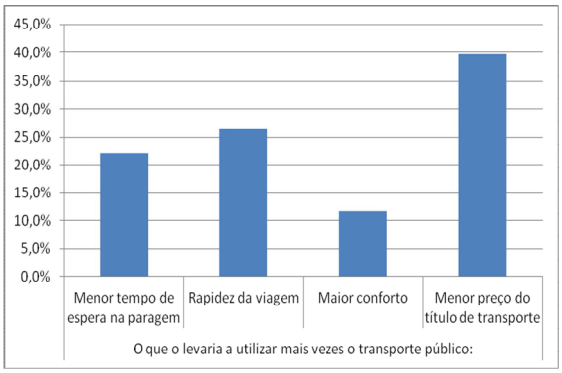
2009



2010



2011



ANNEX 8 Cost-Benefit Analysis Data

The next table shows the values obtained for travel time savings:

Year: 2002	Time savings (€/h)
Work related trips (Bus, Portugal)	15,52
Non-work related trips (Bus, Portugal)	4,81

Source: HEATCO Project. Deliverable D5 Proposal for Harmonised Guidelines (2006) (URL: http://heatco.ier.uni-stuttgart.de/), taken from J. Piao and J. Preston, CBA Recommendations for CIVITAS Evaluation, Transportation Research Group, Southampton University, UK

The following table shows the evolution of inflation rates from 2001-2007:

Year	2002	2003	2004	2005	2006	2007
Inflation Rate (%) since 2000	3,62%	3,29%	2,36%	2,28%	3,09%	2,45%

Source: Bank of Portugal, National institute of Statistics

The following table shows the estimated values of travel time savings:

Year: 2008	Time savings (€/h)
Work related trips (Bus, Portugal)	18,19
Non-work related trips (Bus, Portugal)	5,64
AVERAGE	**11,53**

The estimation of these values is based on the values of travel time savings obtained from POINTER and on the evolution of inflation rates from 2001-2007.

The next table shows the age of SMTUC passengers:

Age (%)	2009	2010	2011
<18	12,6	12,5	6,1
19-25	28,3	32,4	41,2
26-45	23,9	19,6	23,6
46-55	15,2	13,5	15,2
56-65	13,2	10,3	7,9
>62	6,8	11,7	6

Source: SMTUC – Customer satisfaction Survey

The following table shows the motive of the trips of SMTUC passengers

Motive (%)	2009	2010	2011
Home-Work/School	66,8	63,9	70,2
Shopping/Leisure	29,6	31,4	25,5
Work trip	3,6	4,7	4,3

Source: SMTUC – Customer satisfaction Survey

The following table shows the percentage of work related trips and non-work related trips among SMUC passengers:

Motive (%)	2009	2010	2011	Average
Work related trips	47,8	45,1	48,5	47,1
Non-work related trips	52,2	54,9	51,5	52,9

The assumption in this table is that Home-Work/School trips among passengers <18 are 100% Non-work related trips, that Home-Work/School trips among passengers 19-25 are 75% Non-work related trips and that Home-Work/School performed by each age group is proportional to the percentage of SMTUC passengers belonging to that group.