Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Executive summary

In Craiova, before CIVITAS project, the ticketing of the whole public transportation system was based on mechanical validating devices that pierce the paper tickets. The revenues from tickets and season tickets were recorded all together from trams and buses. Public Transportation Company in Craiova had several problems with frauds related to paper tickets validation.

The implementation of a new e-ticketing system for a part of the PT network in Craiova can partially solve the problem related to frauds and give the possibility to collect the money in advance, at least for the lines and vehicles connected to the e-ticketing system.

The purpose of the measure was to integrate the transportation modes based on trams and buses in a common e-ticketing system to have the possibility to record separately the revenues coming from electric transportation (trams) and from road transportation (buses), to have a real time monitoring of the ticketing and to improve the quality of the service.

Within this measure, 80 buses and 27 trams were equipped with e-ticketing validators and integrated in a single system and 30 ticketing automatic machines were installed (10 automatic machines for paper tickets and 20 recharging cards stations).

For a good implementation of the measure, the technical solution for the e-ticketing system applied in Brescia (which is partner of the same MODRERN Project) was adopted in Craiova Public Transport Company. At this purpose, a technological transfer agreement between Brescia Mobilità (PT operator in Brescia) and RAT Craiova has been signed, so the two companies exchanged experiences, information and technical documentation.

The demonstration of the measure within the CIVITAS Modern period showed that this measure was feasible at a relatively low cost in comparison to other ones implemented in other PT operation.

The results obtained in relation to the CBA (Cost-Benefit-Analysis) shows that the measure is both effective and efficient in achieving good positive results in terms of cumulated cost not only during lifetime of the measure but since the first year of implementation. The positive cumulated cost shows that the investment and operating costs can be covered by the collected revenues.

The implementation of the measure brought to RAT many advantages:

- Possibility of real time collection of data about passengers profile;
- Collection of money in advance;
- Limiting the ticket evasion;
- Possibility to integrate 2 transportation systems (electric and road), in a common ticketing system;
- A better knowledge about the number of pas sengers on each line, tram and bus should allow RAT to arrange for a better network management.

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

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A Introduction

A1 Objectives

The measure objectives are:

(A) High level / longer term:

- To modify the modal share
- To introduce advanced ITC technologies

(B) Strategic level:

- To increase the attractivness and accessibility of PT

(C) Measure level:

- To install e-ticketing system on 107 vehicles(80 buses and 27 trams) in order to increase the average number of passengers with (2-3) % and decrease the frauds number of passenger evaders by 3% in PT

A2 Description

PT ticketing system in Craiova was based only on mechanical validation devices, paper tickets and kiosks selling the paper tickets and season tickets. The revenues from tickets and season tickets were collected all together independently from the lines and the vehicles type. Public Transportation Company in Craiova (RAT) recorded several problems related to frauds and ticket evasion with this kind of manual system.

E-ticketing system can avoid the frauds because after blocking of validation devices, the passengers cannot validate the card, and can limit evasion. The e-ticketing system allows the real time collection and analysis of large amounts of data about passengers profile.

This data collection and analysis is necessary to improve the company management: in fact it gives a lot of information which can be used to plan the service. Moreover, this system gives also a financial benefit, as it allows to collect money in advance.

In the public transport system, the requests of the passengers are generally the following:

- easy interchange between different lines and means of transportation,
- efficient and accessible options for the travel.

The card-based method introduced by the e-ticketing systems, give an answer to these requests. The cards, in fact, can be bought and recharged automatically even from home, through the Internet. Because the cards are linked to the single user, they can be annulled if they are lost or stolen. Contact less function of the cards allows the rapid access of the passengers on the PT vehicles. The passengers can use one card for different means of transportation.

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

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The e-ticketing system has the following advantages:

- The passenger has possibility to recharge the card
- Any card validation is transmitted on-line
- The tickets checking is easier and avoid the frauds as when the controller (the operator who check the tickets) goes in the bus or tram, he can block the validating devices.

Another important purpose of the measure was to integrate the transportation mode in Craiova, based on trams and buses in a common e-ticketing system to have the possibility to record separately the revenues coming from electric transportation (trams) and from road transportation (buses) and from the different lines.

Within this measure a significant part of the RAT fleet, namely 80 buses and 27 trams were equipped with e-ticketing system, as follows:

- 2-3 validation devices, depending on the vehicle size, were installed on buses and trams
- 1 on-board display was installed on each vehicle
- 30 ticketing automatic machines including 10 automatic machines for paper tickets and recharging cards installed in passenger stations with 20 recharging cards set installed inside of the RAT tickets selling points

The ticketing automatic machines were placed in the most important stations in the city, in the crowded stations. The picture A2.1 shows a computer from dispatcher and picture A2.2 shows an automatic machine for paper tickets

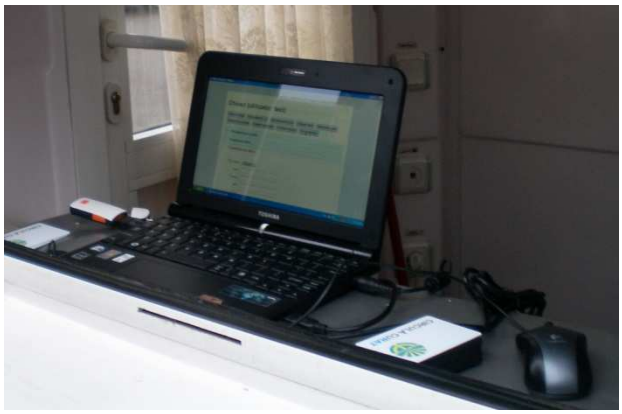

Figure A2.1

Figure A2.2

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

The e-ticketing system implemented in Craiova by CIVITAS project is a pilot e-ticketing system that allows gradual transition from paper tickets to electronic cards. This is the reason for that the mechanical devices for paper tickets were kept on lines where electronic validation devices were installed. Technical solution for e-ticketing system applied in Brescia was transferred in Craiova PT. For this reason, a technological transfer agreement between PT operator in Brescia and RAT Craiova has been signed, and exchange of experiences, information and technical documentation took place.

The e-ticketing system was part of a wider PT management system implemented within the MODERN Project. It includes other modules and precisely:

- An AVM and info-mobility system (also called GPS/GPRS system)
- A video-surveillance system for bus stations and PT vehicles.

All these systems are based on a common and unitary architecture and share part of the equipment.

For this reason the procurement procedure for purchasing the equipments necessary to the e-ticketing system was carried-out together with the GPS/GPRS and the video-surveillance systems procurement procedure.

This procedure took place through the national tender electronic system and five companies submitted tenders.

The provider installed the whole the e-ticketing system, set the communication between dispatcher and all onboard computers from each vehicles and, put the e-ticketing system into the service.

The overall system architecture is represented in figure A.2.3.

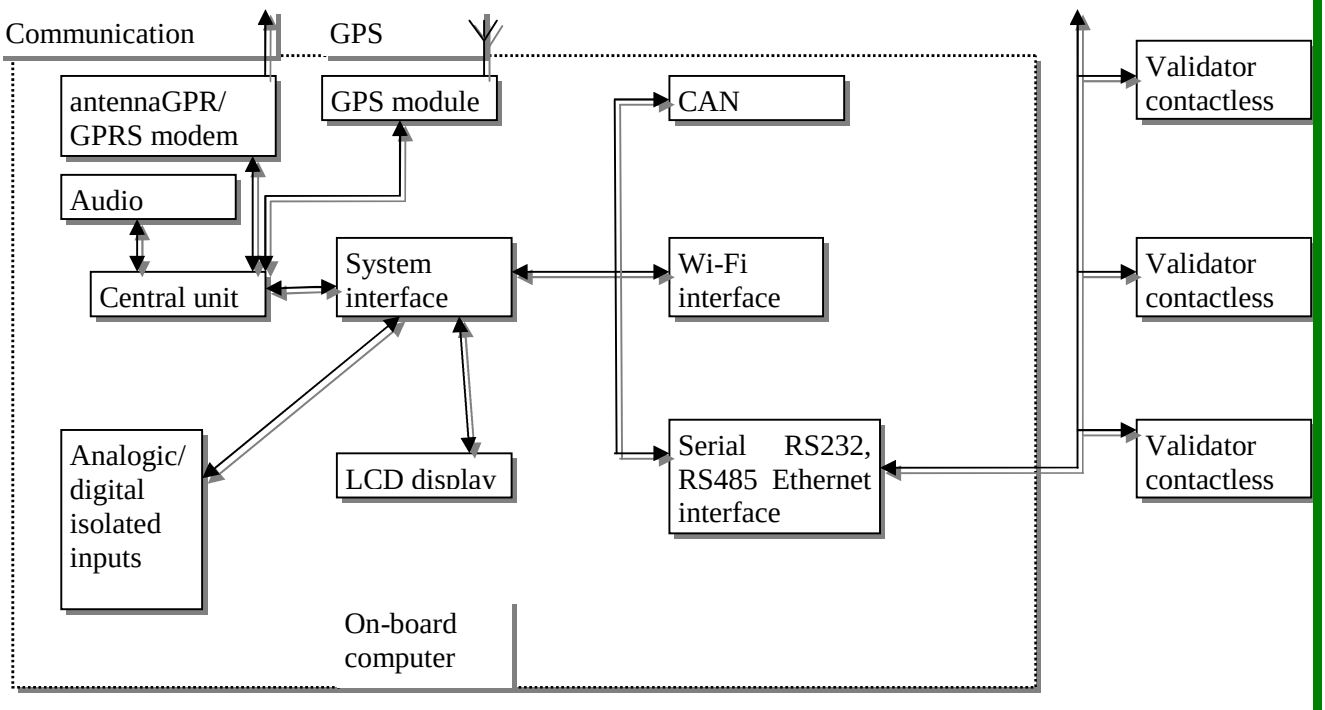

Fig. A2.3. System architecture

The main equipments which make up the system are described in the following with its main technical description:

- Board computer (CB): it was mounted on the vehicles board and it is use to acquire data regarding geographic position and data received from interconnected devices as: electronic informing panels (PDICA); mixed validation unit for contactless cards and paper tickets (VMCH); fixed communication system (EFX)
- Mixed validation units for contactless cards and paper tickets (VMCH): validation for tickets(on normal paper or contactless cards), the possibility to open/close the working session using driver's contactless card, to transmit, when the computer board requests, the stored information about validation, acoustic signaling and optic signaling: display an explicit message for acceptance/rejection of the card etc.
- Terminal Inspector Device (EIT): device portable (hand held) for ticket control
- Contactless cards (CC): are according to ISO 14443 A
- Device Set for Customizing Card Points content: printer for customizing cards, workstation, A4 scanner, webcam, read / write / encoding device for contactless cards, device for security zone reading (hardware module used for MIFARE cards)
- Equipments for Sales and Cards Recharging Point content: printer for fiscal receipts, read / write / encoding devices for contact less cards, workstation, reading device for secure area (hardware module used for MIFARE cards)

The central application software of the e-ticketing system has been implemented using Software Application for Ticketing (AST) consists in two modules: "Front Office" and "Back Office".

Software application for e-ticketing (AST) answers to the subsystems in the following way:

Front Office:

- Subsystem for sale and recharge transport certificates: The sale points which commercialize the contactless cards will use specific equipments (Device Set for Customize Card Points). The subsystem for sale and recharge allows a further extension with new sale points without the intervention of the provider. The transaction is made in on-line operation mode and also in off-line operation mode. Subsystem has to allow the checking of the transactions made in every moment of time in every sale point. At the end of the working day/month it must generates sale reports on each POS in every day/month.
- Subsystem for controlling transport certificates**:** The subsystem for controlling transport certificates must manage the entire control flow for the certificates. With the help of this module the following operations will be accomplished: Verify the validation of transport certificates, Records the controls: number, date, time, hour, vehicles and current routes on which the control was made, Data transfer to Software Application for Ticketing). In case of contactless cards the checking is made electronically through Terminal Inspector Devices (EIT) available for ticket inspectors teams. Each control operation for contactless card will be recorded in EIT for each ticket inspector who will make that operation. The validation unit will be set in state 'control" (blocked) using ticket inspector's card.
- The subsystem for transport certificates validation: The subsystem for transport certificates validation will run on the vehicle. The main functions of this subsystem are: Validation of the travelling documents, Takes over the data from Ticketing Software Application (AST), Transfers to Ticketing Software Application (AST) data concerning and Authentication of the drivers in the system using their cards.

Back Office:

- Subsystem for formatting and pre-charging of the cards: accomplish 2 major functions (formatting the contactless cards delivered by the cards provider and recharging of the cards in order to be commercialized). The subsystem must have the possibility to emit a personalized card including photo, that's why the application it must be able to acquire the photography of the client using, in card customizing points, the following peripherals: web camera and scanner. The subsystem provide the possibility to: check the sales in each sale point in every moment AND at the end of the working day/month to generate sale reports for every POS on every day/month
- Subsystem for user's management: The subsystem ensures the management of all accounts of the Ticketing System users. An account for the user means that the user is authorized by RAT Craiova to use Ticketing Software Application (AST) for exploitation and commercial uses. The subsystem will define the users ant their rights according with each application and also, it may block or reactivate a user account.
- Management subsystem for users cards (drivers, ticket inspectors): The subsystem will emit the cards for the persons authorized to exploit the functionalities of the ticketing system. These cards will be emitted for drivers and ticket inspectors and the procedure of card customization will be the same as the procedure for the season tickets cards, multiple tickets cards, etc. All users cards will be customized only with rights corresponding to the role that the user has relate to the equipment of the ticketing system.
- Management subsystem for price list offer: have a complex definition level for tariff certificates according the next criteria:
    - the begging of availability period for tariff certificates will be established in the moment of sale;
    - the availability period is configured at the level of minutes, hours, days or months,

This information will be transmitted automatically from this module to the sale, pre-charge, validation and control subsystems of tariff certificates.

- Management subsystem for passengers cards: show the global situation of all the transactions performed by the registered cards in the system. The travelling card will have the possibility to record many tariff certificates.
- Management subsystem for the equipments of the entire system: allows to configure internal data for the validation units, visualize specific information (serial number, ID of the vehicle on which the validation unit is mounted, version of the installed software).
- Administration management subsystem: accomplish the next functions:
- to define administration points(sale/pre-charge points, customizing point);
- to allow the transition form active state to passive state and vice versa;
- to allow the definition of an unlimited number of administration points with the appropriate connections between them;

Subsystem for reporting and statistics defined by the contracting authority before the delivery contract is signed: offers a specified number of statistics and reports regarding: Sales, validations, control, contactless cards(travelling and users);

B Measure implementation

B1 Innovative aspects

The innovative aspects of the measure are:

- **New conceptual approach -** The e-ticketing system allows real time transmitting of the data about passengers profile, necessary to PT company management, collection of money in advance and limiting the fraudulent passengers
- **Use of new technology/ITS -** Possibility to integrate 2 transportation systems (electric and road), in a common ticketing system . This is a new technology and very comfortable for PT users.

- **New physical infrastructure solutions**:

  - 80 buses and 27 trams have been endowed with e-ticketing system as follows: 2-3 validation devices depending on vehicles size and 1 front panel computer for each vehicle;
  - 30 ticketing automatic machines (10 automatic machines for paper tickets and recharging cards installed in passengers stations; 20 recharging cards set installed inside of the RAT tickets selling points).

B2 Research and Technology Development

The RTD task aimed to find a solution for e-ticketing system implementation in Craiova , in order to provide a good service for passengers and set a management tool for public transportation company

- Analisys of the current ticketing system in Craiova and e-ticketing systems available on the market

The ticketing system, in Craiova, has been analyzed and they found that there were many types of tickets and season tickets with different prices considering the number of travels, the validity areas, means of transport and social categories. Besides, the ticket price is different according to the selling place of it (if the selling point is inside of transportation means, the ticket price is higher than the ticket price sold from the special kiosks and automatic devices for tickets)

The types of tickets and commutation licenses that could be bought in Craiova were following:

1. One travel ticket with unique price no matter the distance on route in Craiova.
2. One travel ticket in the exterior of the city (Isalnita).
3. Commutation license for one day.
4. Commutation license for 7 days for 1 route.
5. Commutation license for 15 days for 1 route.
6. Commutation license for 1 route: tramway commutation license, bus commutation license, minibus commutation license.
7. Commutation license for 2 routes.
8. Commutation license for 5 routes.
9. Commutation license for all routes.

10. Commutation license for exterior routes.

The smartcard technologies were analised and they found the cards are distinguishable considering the type of chips and according to the type of communicating interface with the reading device. There are three types of chips associated to these cards: memory, haywire and microcontroller. These names of chips refer to the functionalities that they have:

- The cards of memory type are the electronic variant of the magnetic cards. They have a greater capacity (up to 16 Kb) and offer a greater security compared to the magnetic ones. They do not have integrated logic and they do not calculate, are used only for data memory. The older versions were read-only (could only be read), the new versions use memories that can be read and written and can be protected through a PIN code.
- The cards with haywire have a file system and a set of commands with multiple applications and allow the authorized access to the memory content. They include different variants of no contact cards of MIFARE type or the ones in the Ist class.
- The secured cards with microcontroller contain an operation system and a memory of read/write type that can be updated several times. These cards are like a miniature PC; they calculate, store data and execute commands according to their operation system. Unlike the memory type cards, these cards were designed to assure security.

Two main types of interfaces have been found: contact and contactless.

The contact cards require their introduction into a reader to make direct contact with the conductive element placed on the surface of the card. The contactless cards must be near the reading device (generally around 10 cm) for the data transfer to take place. The transfer is made through the radio wave through the antennas present both in the card and in the reading device.

The research team found that, at this moment, there are three main categories of cards used in the world:

- Philips cards of Mifare type;
- Innovatron Calypso cards;
- Sony Felica cards used in the Asian countries.

The research team found that the memory of the card is limited at the present moment both by the costs of these memory types (EEPROM- Electrically Erasable Programmable Read Only Memory) and also by the restrictions connected to the dimension. At this moment, there are available only memory cards starting from 4 to 64 Kbytes, and appear the ones with 100Kbytes. 2-4 Kbytes of memory are enough for the memory of the information connected to the last 100 transactions (data, hour, location, type of service, etc). Memory is chosen connected to the wished expectations and has a great influence over the price of the card.

Also, they found that the encrypting of the information from the card, the numbering of the transactions made are some of the methods used for stopping and detecting frauds.

After the e-ticketing investment cost analyses, an element that has a great influence on investment is the solution adopted for the tickets replacement. They found 5 methods for issuing a ticket in such a system:

- magnetic cards – in this case one can use both card checkers with or without contact;
- smartcards – only the no contact card checkers will be used;

- value deposit cards –the user will deposit on this card a sum that is generally larger than the cost of one travel but which can be reimbursed;
- banking card – requires a collaboration with the card issuing bodies;
- mobile phone – by SMS or by mobile bar code. This thing implies the communication costs and it is possible by using telephones with NFC (Near Field Communication) technology.

The research team listed the advantages and disadventages of the e-ticketing system:

Interested part	Advantages/disadvantages	
Public transport operator	Advantages	- the continuity of the system and an easier integration of the new systems; - the optimization of the acquisition and maintenance costs; - a better use of financial resources; - more bidders.
	Disadvantages	- standard requests; - special requests are not taken into consideration; - possible extra-costs connected to the standardization of the already existent equipments.
Equipment suppliers	Advantages	- the assurance of inter-operability; - the market development; - less special requests.
	Disadvantages	- “leveling” of products (no increase value); - authentications.

The conclusion was the e-ticketing system has a positive impact over the imagine of public transportation.

- **The technical specifications of the proposed e -ticketing system in Craiova**

Taking into consideration all the aspects mentioned before and also considering the implemented systems inside other operators of public transport at national level, the research team outlined some technical specifications of the e-ticketing system proposed for Craiova.
These technical specifications were included in the technical tender for e-ticketing system purchasing.

Card check

- mix (no contact and on paper);
- minimum technical characteristics:

- LCD display;
- interface RS485 and/or Ethernet;
- accepted cards: ISO 14443 A and ISO 14443 B;
- transaction storing capacity: minimum 8000 transactions;
- central unit equipped with minimum 1MB RAM operation memory, minimum 4MB FLASH data memory, minimum 2MB FLASH program memory, processor 32 bits.
- Protection of the data stored in case of accidental loss of the input voltage;
- protection degree: minimum IP54;
- vandalism protection carcass;
- function time: minimum 80000 hours;
- input voltage: 16VDC - 33VDC.

- Minimal functional characteristics:

  - Validation of the transport titles (on normal paper and no contact cards);
  - To print on the paper ticket: hour, data, number of the vehicle and the route;
  - To be able to open / shut the working session with the no contact card by the driver;
  - To transmit at board computer's request the stored validation information;
  - Anti-pass back function;
  - To allow the blocking of the validation process in the function module – „ticket control" by using the no contact card by the controller;
  - To signal in an acoustic and optical way, and by displaying an explicit message for the acceptance/rejection of a validation;
  - The taking over of the information in the Software Taxation Application (AST) by the board computer of the prices, „black list", transport lines, drivers in the public transport.

Terminal Inspector Equipment – EIT

- portable.
- minimum characteristics:

  - endowment with autonomous accumulator for minimum 10 hours;
  - LCD display;
  - possibility of data transfer (that means costs);
  - shock resistance;
  - reduced weight;
  - software PC communication.

No contact cards – CC

The no contact cards must be conforming to 14443 A and ISO 14443 B:

- Mifare 1 K cards for the realization of driver /watt man cards and of the cards of the controllers with transport titles;
- Mifare 1 K cards for the commutation licenses and electronic wallet/ multiple tickets.

Set equipments for location card personalization

- printer for cards' personalization;
- PC station;

- A4 scanner;
- WEB camera;
- positive device for reading/writing/codification of no contact cards;
- device for reading the security application (electronic hardware mode used for the security of coding the MIFARE cards).

Set equipments for location selling and recharging cards

- printer for tickets;
- device for reading/writing/ codification of no contact cards;
- PC station;
- device for reading the security application (electronic hardware mode used for the security of coding the MIFARE cards).

Automatic devices for selling tickets

- The automatic devices have the role of issuing travel tickets in the passengers' stations.
- The tickets issued must have standard dimensions; printing must be made on thermal paper with the weight of 110 g/m², no consumables.
- On the surface of the ticket the following information must be written:
    - the series of the ticket, the series of the automatic device that issued the ticket, the hour and the minute, the date, and the price;
    - all the other information: the name of the company, validity, messages for passengers must be changed in real time from the dispatch application.

- They must accept banknotes and coins, to have the possibility of giving change with at least two types of coins.
- Money must be stored in metallic boxes, with the possibility of being locked for a safe transport.
- The money boxes must be accompanied by monetary, issued by the automatic device, on which the accurate information will be printed about the number of papers and banknotes in this boxes.
- The equipment must resist to bad weather, humidity, dust and vandalism.
- The equipment must be endowed with an alarm system that must be connected to the WEB dispatch application.
- The equipment must permanently be connected to the WEB dispatch application.
- The equipment must be endowed with LCD display.
- The information must be printed in Romanian.

- **The system must allow the configuration for issuing more types of tickets and even commuters' licenses, in this case, the user will have at its disposal a numerical anti-vandalism keyboard for the introduction of the PNC.**
- **The shutting must be made with a special safety key in minimum 5 points.**
- **The equipment must give the change and the tickets in different holes.**
- **Evidence software.**

Software Taxation Applications by AST

The software taxation application is formed by the following modules:

- „Front Office" that contains the software subsystems that interact with the passenger;
- „Back Office" that contains the software subsystems that do not interact with the passenger, but have the role of data centralization, data verification and data validation for obtaining the statistic reports.

"Front Office" module contains:

- the selling subsystem and the recharging of the transport titles;
- the control subsystem of the transport titles;
- the validation subsystem of the transport titles.

"Back Office" module contains:

- Formatting subsystem and pre-charge cards subsystem;
- Users' management subsystem;
- Management subsystem of the operators' cards (drivers in the public means of transport, controllers);
- Management subsystem of the price offer;
- Management subsystem of the passenger's cards;
- Management subsystem of the system's equipments;
- Management stock subsystem;
- Subsystem for reports and statistics defined by the contracting authority before signing the delivery contract.

- Data research and study about e-ticketing system

The public procurement procedures and the legislation for the purchasing the e-ticketing system were studied. The research team analyzed various companies that produce e-ticketing systems and studied implemented solutions in other public transport systems in Romania and in other CIVITAS cities.

The technical solution for e-ticketing system applied in Brescia was a good practice for Public Transportation (PT) in Craiova. For this purpose, a technological transfer agreement has been signed

between PT operator in Brescia and RAT Craiova, and exchanged experience, information and technical documentation.(TT agreement is attached to the MERT – Annex1)

B3 Situation before CIVITAS

In Craiova, before the CIVITAS MODERN project, the ticketing of the whole public transportation system was based on mechanical validating devices that pierce paper tickets. The revenues from tickets and season tickets were recorded all together (from trams and buses and for all the lines). Public Transportation Company in Craiova had significant problems with frauds and ticket evasion related to paper tickets validation.

The implementation of the e-ticketing system in Craiova PT can solve these problems, giving the possibility to collect the money in advance, and can insure an accurate accounting of the incomes per each single line.

B4 Actual implementation of the measure

The measure was implemented in the following stages:

Stage 1: Planning and design of the measure (Oct 2008-May 2009)

The activity was detailed in the preceding chapter and included an analysis of the current ticketing system in Craiova and e-ticketing systems available on the market. The advantages and disadvantages of the e-ticketing system were outlined and the technical specifications of the proposed e -ticketing system in Craiova were carried out. These technical specifications were included in the technical tender for e-ticketing system purchasing.

- The technical specifications referred to:
- Card check
- Terminal Inspector Equipment – EIT
- Type of cards: No contact cards – CC
- Equipment for card customization
- Equipment for selling and recharging cards
- Automatic devices for selling tickets
- Application Software for Ticketing - AST

Stage 2: Study about e-ticketing system e-ticketing procurement procedure

- **Technical solution finding** (Oct 2008- Jan 2010)

For the adaptation of the technical solution we considered the field experience of the consortium and of the local and national specifics.

This system should have to respond to the integration possibilities of the two modes of transport in Craiova (trams and buses) and further possibilities of extension on other transport modes.

The adopted technical solution has been implemented with success, and integrated into a single management system all the activities from E-ticketing measure, GPS/GPRS measure and Security in Public Transport measure.

- **Procurement procedure carrying out** (Feb 2010- Jul. 2010)

In this period the public procurement procedures, the legislation for the e-ticketing system purchasing and the integration of the whole Public Transport management system (including as mentioned e-ticketing, GPS/GPRS and video-surveillance) were studied. For this reason, integrated technical specifications for the whole PT management system acquisition were developed. The three relevant MODERN measures (namely 02.04, 05.05 and 08.02), formed a group of actions that constituted an integrated complex system of:

- monitoring,
- security
- management of public transportation in Craiova.

A common procurement procedure for purchasing the equipments necessary to the e-ticketing, GPS/GPRS and video-surveillance systems has been carried out. The procurement procedure took place through the national tender electronic system and five companies' submitted tenders, and the winner was the company ALIEN Concept from Oradea, Romania.

The result of the tender was contested by 4 companies but all the appeals were rejected by the National Claims Settlement Commission. Two of the contestant companies continued to claim the tender result in the Court of Law. The contestation process ended on June 2010 in favor of RAT and the contract with the winner company was signed at the end of June 2010.

- **E-ticketing system delivery and installing** (Aug. 2010-Jan 2011)

The following main activities were carried out

- 80 buses and 27 trams were equipped with e-ticketing system, as follows:
  - 2-3 validation devices, depending on vehicle size, were installed on buses and trams
  - 1 on-board display was installed on the buses and trams
- 30 ticketing automatic machines (10 automatic machines for paper tickets and recharging cards installed in passengers stations; 20 recharging cards set installed inside of the RAT tickets selling points)
- contracts with data transmission companies were signed: RCS-RDS and Vodafone
- the central control room (dispatching) was equipped with server and specific devices for the system's monitoring and displays.
- specific air conditioning system for the dispatching room was installed

Figure B4.1 – E-ticket machine on a bus

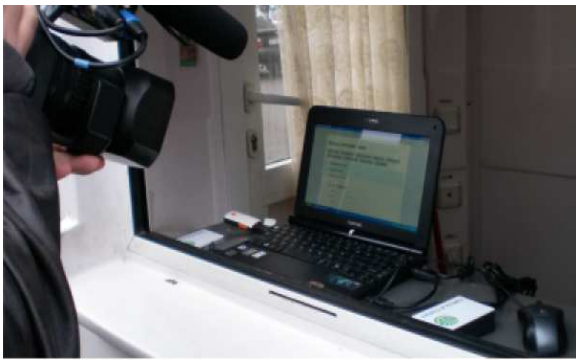

Figure B4.2 – Dispatcher room

The buses have been cabled to a separate communication and power supply network for the e-ticketing system so there is a 24V power supply from the system generator which receives 24V and releases 12V. The 2 x 1,5 supply cable for each identification device and the UTP communication cable from the second or third identification device to the first one and from the first one to the board computer.

The board computer was connected to a GPS/GPRS module that has in the interior a Vodafone data card. The same module was connected to the communication antenna on the roof of the bus.

In the picture B 4.1 the number of the buses and trams equipped with e-ticketing system compared with the overall fleet is shown.

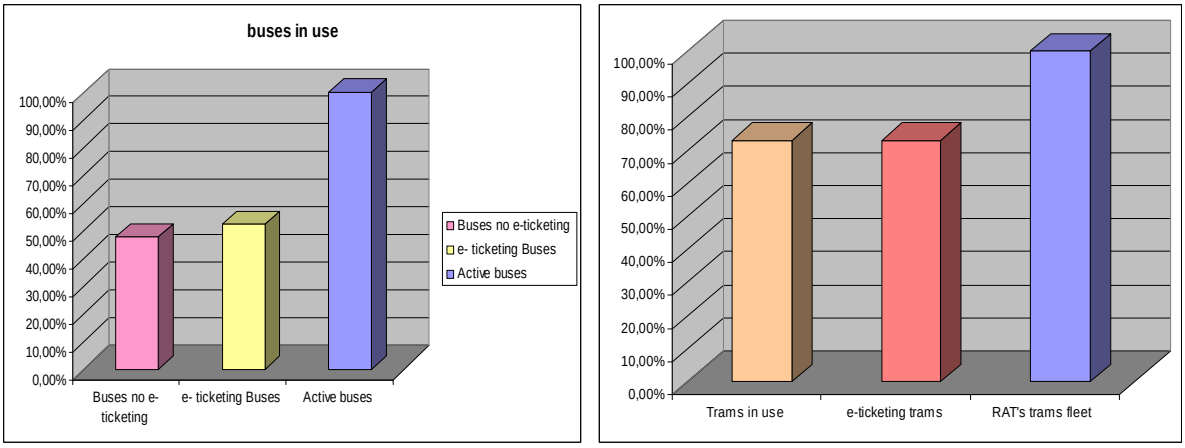

Figure B4.3 – Trams and buses equipped .vs. overall fleet

Stage 4 – Training for involved technicians (Aug 2010- Jan 2011)

The technicians training process has been held in the same time with the system's installation. The technicians appointed from RAT participated at the system installation activity together with the specialists from the company providing the e-ticketing system. During the assembly and installation of the system they learned how the system runs.

Figure B4.2- dispatcher room

Stage 5: System operation (May 2011- Sept 2012)

The e-ticketing system works as follows:

- The communication with the server from the dispatcher is done through a M2M (VPN) protocol that includes Vodafone data cards (purchased through a contract signed with Vodafone) and that are installed on the vehicles and at the dispatcher in a CISCO specialized router that connects the VPN (Virtual Private Network) of the Vodafone to the dispatcher software.
- Using the same method (VPN and Vodafone) the transmission of gathered data from the ticket and recharging card automats (sold tickets, card recharges, money in automat, money in the change boxes) is ensured.
- The 20 recharging card points located in 10 bus stations include a computer with specialized software, one reader, one cash register and the communication with the server through RDS subscriptions of optic fiber internet is ensured.
- The traveler's card point includes a computer with a specialized software, a scanner for reading ID data, card reader and printer for printing cards and it is connected to the central dispatcher through RDS optic fiber internet.

The board computer software takes over each validation from the identification device along with the needed information (date, time, first name, last name, PNC) and sends them to the database server from the dispatcher, introducing them into a database.

Having a real time network at the dispatcher, one can know how many traveling tickets or cards have been sold, how many old cards have been recharged and how many validations have been done in each vehicle.

Equipments used for Software Application for Ticketing:

a. Server for Data Base
b. Server for Software Application for Ticketing
c. Server for Ticket Inspectors Database

For all the applications from each server from above back-up hardware function are provided. Additionally to these active hardware equipments (3 above servers) a forth server are provided for backup of every one of the three working servers in case of damage.

Even if the measure was fully implemented, the e-ticketing system has been only tested (1.254 sold tickets).

B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **M 05.05** Public Transport Security program in Craiova
- **M 08.02** Info mobility tools for fleet management in Craiova

The measures M 02.04, M05.05 and M 08.02 are closely linked since they share the same infrastructure(buses , trams and monitoring station). A commune procurement procedure was organized for the three measures. The on board control units were integrated to ensure the best performance and to provide an up-to-date technological solution. The monitoring central system of these measures share the same hardware architecture and integrate as much as possible the software applications

C Impact Evaluation Findings

C1 Measurement methodology

C1.1 Impacts and Indicators

Table C1.1: Indicators. Insert your own table where available, use landscape layout as necessary

No.	Impact	Indicator	Data used	Comments
1	Economy	Average Operative revenues	The revenues from fares and tickets	The general revenues decreased after the measure implementation because the tramways lines were shortened during the construction of the overpass which crossed the tram tracks. Shortening of tramways led to fragmentation of travels and hence to decrease the number of passengers. Other reason for that the number of passengers decreased in 2011 and 2012, was related to cancellation of some facilities for pensioners gave by RAT in 2009 and 2010
2A		Average Operating costs	Annual operating costs: Personnel, Energy, Spare parts and maintenance, Other costs	Increased after measure implementation but can be covered by the operating revenues
2B		Capital cost	Investments costs	The cumulated cash flow shows that the investments cost can be recovered.
13	Society	Awareness level	Face to face and phone survey	Face to face and phone surveys to PT referring to having heard of e-ticketing system, understand the aim of the measure and the potential benefits and non benefits of it
14		Acceptance level	Face to face and phone surveys	Perception on acceptability of the e-ticketing system
Local indicator		Proportion of passengers traveling without tickets	%	RAT's registration concerning passengers traveling without tickets

28	Transport	Average occupancy	Number of passengers per vehicle per trip	RAT data base Monitors' registration on tram line(101 102), E1R, E1T, line 9

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 service (€/vkm)

B = Total operational revenue coming from trams and buses for the service (€)

C = Total vehicle-kilometers (vkm) traveled by the trams and buses in services

RAT Company provided the revenues coming from season tickets and tickets and Km traveleld by trams and buses in service. Transport Company provided total amount of revenues because they do not have a separately evidence of revenues coming from trams and revenues coming from buses,

but noting that the revenues coming from trams can be estimated, annually, as a percentage of the total revenues, depending on the season tickets sold and number of passengers per trip. The season tickets are the only documents sold by routs or tram lines, while the tickets can be used for buses and trams, too

Indicator 2 A (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, Energy, Maintenance, internet communication and supplies costs related to the RAT PT service (€)

C = Total vehicle-km traveled by the trams and buses in services

RAT Company provided all the operation costs related to ticketing service

(See annex 2: Costs calculation)

Indicator 2B (Capital cost) - Investment cost for the e-ticketing system

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The Capital cost resulted from the purchasing and installation of e-ticketing systems on 80 buses and 27 trams, 10 automatic ticketing machines and 20 recharging cards computers. The capital cost is according to purchaising invoice.

Indicators 13, 14(Awareness level and Acceptance level) - Survey based perception of benefits or disadvantages of the e-ticketing system

The survey was carried out to evaluate the impact of the e-ticketing system on PT users

The questionnaires included also questions referring to e-ticketing and GPS / GPRS measures, because these measures were implemented on the same vehicles

The sample size was calculated for a population of 300.000 people in Craiova.

To calculate the sample size, some data were used:

- confidence level : 87.50%,
- percentage of people that picks a particular answer: 0.85
- confidence interval (also called margin of error): 0.05

The questionnaires were structured in 2 sections:

- General information about citizens (job, age, gender, education level, contact data)
- Questions referring to the measure by indicator type

a. Acceptance level

The most important questions were:

- What is your opinion related to electronic validating devices and e-ticketing system?(1-3 scale)
- Willingness to implement the measures (Do you want to implement the measure?) (Yes/No/Do not know)
- Which is the reason why you want that the e-ticketing system is implemented? (open question)

b. Awareness level

The most important questions were:

- Have you heard about the measure? (yes/No/Don't know)
- Do you understand the aim of the project and the potential benefits and disadvantages of the measure?(1-3 scale)
- Have you noticed the benefits during the time past?(yes/No/Don't know)

Local indicator(%) – Proportion of passengers that tarveling without tickets

RAT Craiova provided the proportion of passengers that traveling without tickets related to total number of passengers, on the rout E1R, rout E1T, rout no. 9 and tram line.

Indicator 28 Average occupancy(peak/off-peak) average number of passengers per vehicle per trip

The average occupancy indicator is measured by counting the number of passengers in off-peak and peak period of day. The frequency of data collection was once a week, twice a day. The measurements were made once in peak period of the day and once in off-peak of the same day. The monitored lines were: tram line, E1Rbuses rout , E1T buses rout, and rout no.9. These routs have been monitored for 1 month, before and after measure implementation. (See annex 4 – occupancy monitoring)

C1.2 Establishing a Baseline

The baseline is year 2009, when in Craiova, all the trams and buses were operating with mechanical taxation system and RAT Company did not has clearlly records of revenues by type of transportation means and by lines.

Average operating revenues

PT company from Craiova recors the incomes from tickets and season tickets in a common database, without possibility to split the revenues coming from different routs. They estimated the revenues coming from trams, as a percentage of total revenues, depending on season tickets sold and the number of passengers per trip. The season tickets are the only documents sold by routs or tram lines, while the tickets can be used for buses and trams, too. In 2009, before the measure implementation, RAT assumed that the percentage allocated to the trams was 26% of total revenues.

Average operating revenue for buses is calculated as ratio between estimated revenues from buses and mileage of buses and average operating revenue for trams is calculated as ratio between estimated revenues from trams and mileage of trams.

Raw data and indicator calculation	2009 Ex-Ante values
Total revenues from season tickets and tickets coming from trams and buses	8’160’548.6 €
Revenues from trams estimated as percentage of total amount of revenues from season tickets and tickets(the percentage was 26% of total revenues)	2’121’742.6 €
Total mileage of trams fleet	893’497 Km
Average operating revenue for trams	**2.3746 €/vkm**
Revenues from buses estimated as percentage of total amount of revenues from season tickets and tickets(the percentage was 74% of total revenues)	6’038’805.97 €
Total mileage of buses fleet	7’216’618 Km
Average operating revenue for buses	**0.8368 €/vkm**

Average operating costs

Average operating costs were calculated as a ratio between the total operating costs from trams and buses prepared for installation of the e-ticketing system and the total mileage of these trams and buses.

We must underline that this is the cost related only to the function of ticketing, and does not include costs like drivers, fuel etc.

Raw data and indicator calculation	**2009 Ex-Ante values**
Total Operational Costs coming from the trams and buses prepared for e-ticketing system*(detalied operating costs are shown in the annex 1)*	11'771.42 €
Total km traveled by the buses prepared for e-ticketing system	2'945'536 Km
Total km traveled by the trams prepared for e-ticketing system	893'497 Km
Average operating cost	0.003 €/vkm

Note: The operating costs include personnel, supplies and other costs, related to the old tiketing system only. Other costs(administration costs) are 20% of personel costs.

Total capital cost

Total capital cost is the cost of investment . In 2009 there was no investment in e-ticketing system.

Raw data and indicator calculation	2009 Ex-Ante values
Investment in the purchase of the e-ticketing system	0,00 €
Total capital cost	0,00 €

Percentage of fraudulent travellers

The travellers without ticket were monitored for 1 month, in September 2010, before e-ticketing implementation. The percentages have been calculated tacking into consideration the number of fraudulent passengers related to total number of passengers.

Buses and trams lines monitored	2010 Ex-Ante values
E- 1T	7%
E-1 R	8%
Line 9	5%
Tram line	7%

Average occupancy

The average number of passengers was monitored for 1 month – September 2010, before the e-ticketing implementation. RAT provided average occupancy for the lines where buses and trams are equipped with e-ticketing system: line E1R, line E1T, line No. 9 and Line No101 (tram line). Occupancy data were collected by RAT personnel, one day a week, in peak and off-peak periods of the day.

Routs and lines monitored	**2010 Ex-Ante values Average occupancy-off-peak**
Line 101- tram line	65%
Rout E1T	50%

Routs and lines monitored	**2010 Ex-Ante values Average occupancy-off-peak**
Rout E1 R	60%
Rout No. 9	60%

Routs and lines monitored	**2010 Ex-Ante values Average occupancy-peak**
Line 101- tram line	70%
Rout E1T	55%
Rout E1 R	65%
Rout No. 9	65%

Awareness level

The questionnaires were disseminated to public transport users in stations for routs E1T, E1R, line No.9, tram line, and during workshops organized by MODERN project team.

The workshops were organized during the Communication Campaign and seminar presentation that took place in May 2010, in the prefecture market (in downtown). 160 questionnaires were circulated and 120 feedbacks were received from people that expressed their opinion about the e-ticketing system from which were processed only 119 accordingly with the sample size.

The person interviewed in the ex-ante period of this measure gave their agreement in order to be again interviewed in the ex-post period of the measure.

Questionaire content	**2010 Ex-Ante values**
Public transport user	80 % yes 5 % No 15 % occasionally
fairly well understand	20%
well understand	40%
very well understand	36%
don't know	4%
The most important information source	Media-25% Transport Company of Craiova- RAT website – 40% Colleagues- 30% Forums or similar on the internet- 5%
Do you know the MODERN project and measure ?	3 % yes 97 % No

Acceptance level

Questionaire content	2010 Ex-Ante values
What is your opinion related to electronic validating devices and e-ticketing system?	Less good 25% Good 35% Very good 38 % Don't know 2%
Willingness to implement the e-ticketing system	Accept 83% Do not accept 15% Do not know 2%
Which is the reason for that you want to implement the e-ticketing system? *(For travellers that accept the measure)*	To reduce the tickets selling time 50 % A modern travel mode 30% Old system is obsolete - 3%
Which is the reason for that you do not want to implement the e-ticketing measure ? *(For travellers that do not accept the measure)*	cannot handle e-commerce or any other e- activity 10% extra responsibility related to electronic cards 5%

C1.3 Building the Business-as-Usual scenario

Craiova had no plan to implement an e-ticketing system for bus services. Thus, in the absence of the CIVITAS MODERN project, RAT would not have developed any e- ticketing technology based on electronic devices. In the current risk climate of economic recession it seems very unlikely that such a project would have been completed.

Average operating revenue

In 2010, RAT assumed that the revenues from trams are estimated as 26 % of total revenues from tickets and season tickets recorded in the common data base.

In 2011 and 2012, according to season tickets sold and the number of passengers per trip, RAT assumed the revenues from trams are estimated as 13 % of total revenues from tickets and season tickets. The decreasing of passengers number that used trams in 2011-2012 led to a decreasing of estimated revenues from trams. The number of passengers decreased in 2011-2012 because the tramways have been shortened during the construction of the overpass which crossed the tramways. Shortening of tramways led to fragmentation of travels and hence decreasing the number of passengers

For BAU case, RAT assumed that the revenues could not be influenced by the measure and BAU revenues follow the values recorded by RAT in 2010, 2011 and 2012.

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Raw data and indicator calculation	**2010 BAU values**
Total revenues from season tickets and tickets coming from trams and buses	8'733'781.4 €
Revenues from season tickets and tickets coming from trams (26% of total revenues)	2'270'783.16 €
Total mileage of trams fleet	819'643 Km
Average operating revenue for trams	**2.7705 €/vkm**
Revenues from season tickets and tickets coming from buses(74% of total revenues)	6'462'998.23 €
Total mileage of buses fleet	5'922'422 Km
Average operating revenue for buses	**1.0913 €/vkm**

Raw data and indicator calculation	**2011 BAU values**
Total revenues from season tickets and tickets coming from trams and buses	5'633'582.64 €
Revenues from season tickets and tickets coming from trams(13 % of total revenues)	732'365.74
Total mileage of trams fleet	524'251Km
Average operating revenue for trams	**1.3970 €/vkm**
Revenues from season tickets and tickets coming from buses(87% of total revenues)	4'901'216.90 €
Total mileage of buses fleet	5'993'980 Km
Average operating revenue for buses	**0.8177 €/vkm**

Raw data and indicator calculation	**2012 BAU values**
Total revenues from season tickets and tickets coming from trams and buses	5'076'565 €
Revenues from season tickets and tickets coming from trams(13 % of total revenues)	659'953.45 €
Total mileage of trams fleet	533'341 Km
Average operating revenue for trams	**1.2374 €/vkm**
Revenues from season tickets and tickets coming from buses(87% of total revenues)	4'416'611.55 €
Total mileage of buses fleet	5'654'378Km
Average operating revenue for buses	**0.781 €/vkm**

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Average operating costs

RAT assumed that the operating costs keep the same values over years 2010, 2011 and 2012 because in BAU situation the 80 buses and 27 trams kept the old ticketing system, without CIVITAS project.

All the costs are divided by the real mileage of the 80 buses and 27 trams for the years considered.

Raw data and indicator calculation	**2010 BAU values**
Total Operational Costs coming from the trams and buses with old ticketing system(detalied operating costs are shown in the annex 1)	27'294.93 €
Total km traveled by the 80 buses that kept the old ticketing system	3'665'503 Km
Total km traveled by the 27 trams that kept the old ticketing system	819'643 Km
Average operating costs	0.006 €/vkm

Raw data and indicator calculation	**2011 BAU values**
Total Operational Costs coming from the trams and buses with old ticketing system(detalied operating costs are shown in the annex 1)	27'294.93 €
Total km traveled by the 80 buses that kept the old ticketing system	3'681'844 Km
Total km traveled by the 27 trams that kept the old ticketing system	524'251Km
Average operating cost	0.0064 €/vkm

Raw data and indicator calculation	**2012 BAU values**
Total Operational Costs coming from the trams and buses with old ticketing system(detalied operating costs are shown in the annex 1)	27'294.93 €
Total km traveled by the 80 buses that kept the old ticketing system	3'264'988 Km
Total km traveled by the 27 trams that kept the old ticketing system	533'341Km
Average operating costs	0.0071 €/vkm

Total capital cost

There is no investment cost in e-ticketing system in the BAU scenario.

Indicators and respective parameters	BAU values
Investment in the purchase of the e-ticketing system	0,00 €
Total capital cost	0,00 €

Percentage of fraudulent travellers

The indicator keeps the same ex-ante values by routs, for the years 2011 and 2012, considering no e-ticketing system.

Buses and trams lines monitored	2011, 2012 BAU values
E- 1T	7%
E-1 R	8%
Line 9	5%
Tram line	7%

Average occupancy

The indicator keeps the same ex-ante values by routs, for the years 2011 and 2012, considering no e-ticketing system.

Routs and lines monitored	2011, 2012 BAU values Average occupancy-off-peak
Line 101- tram line	65%
Rout E1T	50%
Rout E1 R	60%
Rout No. 9	60%

Routs and lines monitored	2011, 2012 BAU values Average occupancy-peak
Line 101- tram line	70%
Rout E1T	55%
Rout E1 R	65%
Rout No. 9	65%

Awareness level

The indicator keeps the same ex-ante answers, for the years 2011 and 2012, considering no e-ticketing system.

Questionaire content	2011, 2012 BAU values
Public transport user	80 % yes 5 % No 15 % occasionally
fairly well understand	20%
well understand	40%
very well understand	36%
don't know	4%
The most important information source	Media-25% Transport Company of Craiova- RAT website – 40%

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Questionaire content	**2011, 2012 BAU values**
	Colleagues- 30% Forums or similar on the internet- 5%
Do you know the MODERN project and measure ?	3 % yes 97 % No

Acceptance level

The indicator keeps the same ex-ante answers, for the years 2011 and 2012, considering no e-ticketing system.

Questionaire content	2011, 2012 BAU values
What is your opinion related to electronic validating devices and e-ticketing system?	Less good 25% Good 35% Very good 38 % Don't know 2%
Accept to implement the e-ticketing system	Accept 83% Do not accept 15% Do not know 2%
Which is the reason for that you want to implement the e-ticketing system? *(For travellers that accept the measure)*	To reduce the tickets selling time 50 % A modern travel mode 30% Old system is obsolete - 3%
Which is the reason for that you do not want to implement the e-ticketing measure ? *(For travellers that do not accept the measure)*	cannot handle e-commerce or any other e- activity 10% extra responsibility related to electronic cards 5%

C2 Measure results

To evaluate the results, a campaign of data measurement related to the different indicators has been carried out. In this section the analysis of these measurements and the synthesis of the result is outlined.

C2.1 Economy

The years for ex-post measurements are considered 2011 and 2012.

Average operating revenues

After CIVITAS measure, in 2011 and 2012, RAT still recorded the incomes from paper tickets and season tickets in a common database, without possibility to separate the revenues coming from different routes, but they has a record of cards sold by routes and by type. Given that the vehicles connected to e-ticketing system are still running in parallel with mechanical validation devices for paper tickets, it is very difficult to see the influence of the measure on RAT revenues

In 2010, RAT assumed that the revenues from trams are estimated as 26 % of total revenues from tickets and season tickets recorded in the common data base.

In 2011 and 2012, according to season tickets sold and the number of passengers per trip, RAT assumed the revenues from trams are estimated as 13 % of total revenues from tickets and season tickets recorded in the common data base. The decreasing of passengers number that used trams in 2011-2012 led to a decreasing of estimated revenues from trams. The number of passengers decreased in 2011-2012 because the tramways have been shortened during the construction work of the overpass which crossed the tramways. Shortening of tramways led to fragmentation of travels and hence decreasing the number of passengers. Other reason for that the number of passengers decreased in 2011 and 2012, was related to cancellation of some facilities for pensioners gave by RAT in 2009 and 2010

RAT assumed that the revenues from ex-post follow the BAU values, for years 2011 and 2012, noting the revenues from cards sold in 2011 and 2012.

Raw data and indicator calculation	**2011 Ex-post values**
Total revenues from paper season tickets, tickets and electronic cards coming from trams and buses	5’633’582.64 €
Total revenues from paper season tickets and tickets coming from trams and buses	5’632’008.22 €
Revenues from sold cards related to buses and trams connected to e-ticketing	1’574.42 €
Revenues from trams (13% of total revenues)	732’365.74 €
Total mileage trams fleet	524’251Km
Average operating revenue from trams	**1.3970 €/vkm**
Revenues from buses (87 % of total revenues)	4’901’216.90 €
Total km traveled by the buses fleet	5’993’980 Km
Average operating revenue from buses	**0.8177 €/vkm**

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Raw data and indicator calculation	**2012 Ex-post values**
Total revenues from paper season tickets, tickets and electronic cards coming from trams and buses	5’076’565 €
Total revenues from paper season tickets and tickets coming from trams and buses	5’066’339.42 €
Revenues from sold cards related to buses and trams connected to e-ticketing	10’225.58 €
Revenues from trams (13% of total revenues)	659’953.45 €
Total mileage of trams fleet	533’341 Km
Average operating revenue for trams	**1.2374 €/vkm**
Revenues from buses (87 % of total revenues)	4’416’611.55 €
Total mileage of buses fleet	5’654’378 Km
Average operating revenue for buses	**0.781 €/vkm**

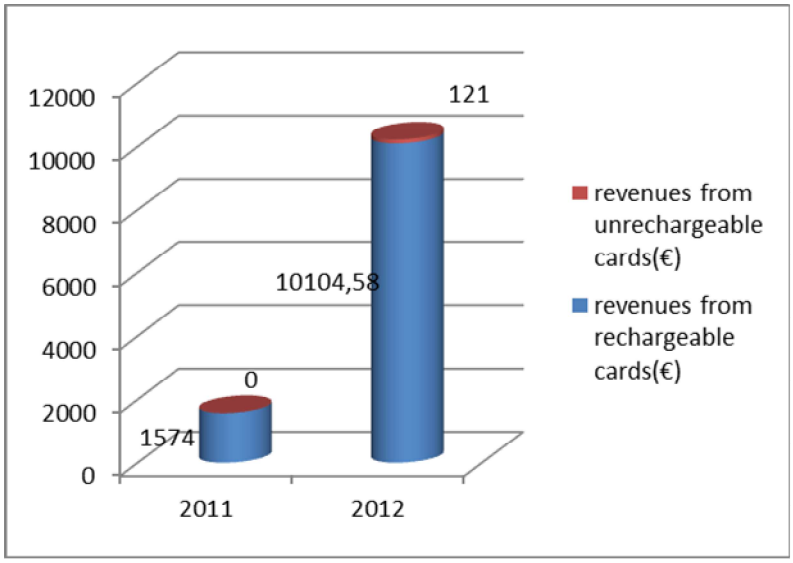


Fig. C2.1.1 – Evolution of revenues from cards sold in 2011-2012

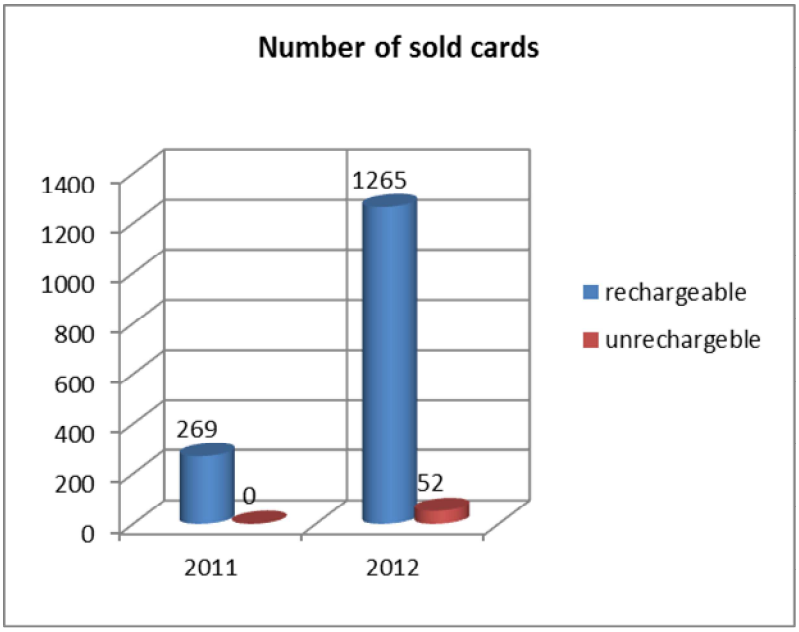


Fig. C2.1.2 – Number of sold cards per type in 2011-2012

Average operating revenue for trams (€/vKm)	2009	2010	2011	2012
ex-ante	2.3746			
BAU	2.3746	2.7705	1.3970	1.2374
ex-post CIVITAS	2.3746	2.7705	1.3970	1.2374

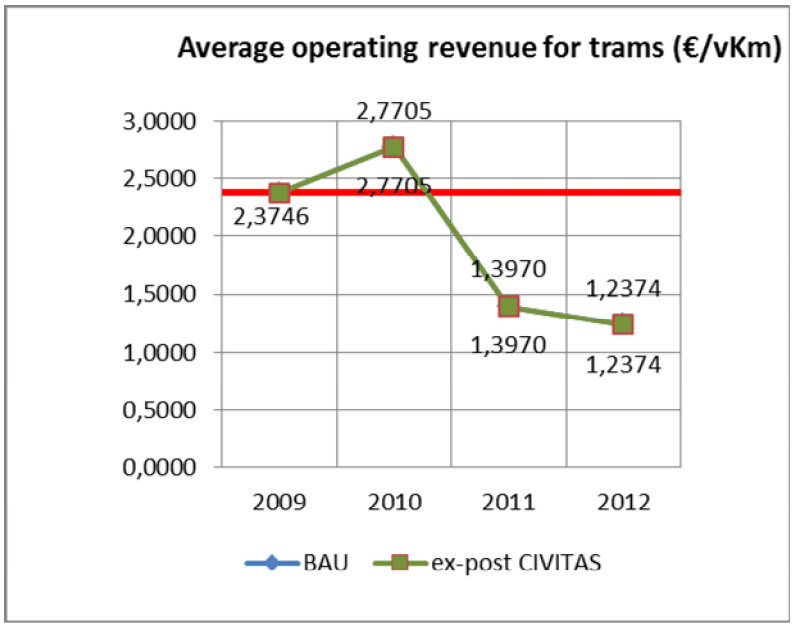


Fig. C2.1.3 – Evolution of average operating revenues for trams

Average operating revenue for buses (€/vKm)	2009	2010	2011	2012
ex-ante	0.8368			
BAU	0.8368	1.0913	0.8177	0.781
ex-post CIVITAS	0.8368	1.0913	0.8177	0.781

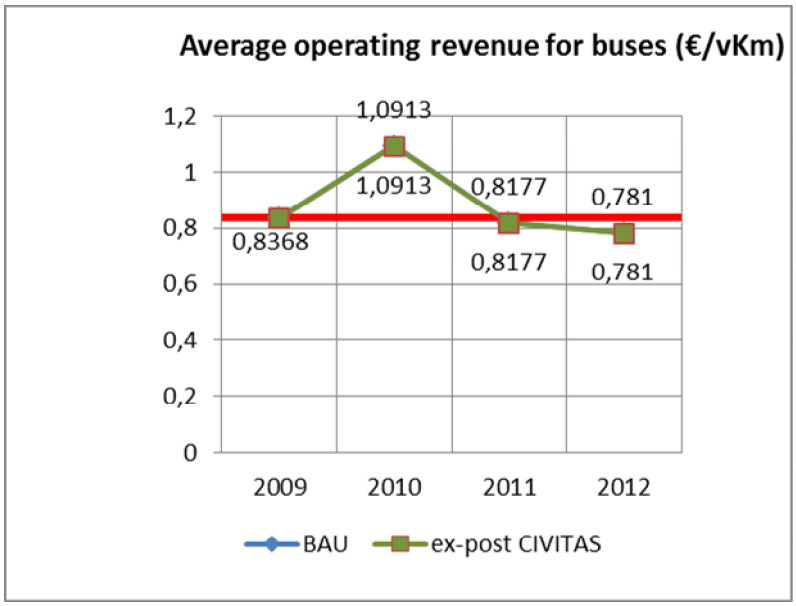


Fig. C2.1.4 – Evolution of average operating revenues for buses

Average operating costs

In the ex-post period, 2011 and 2012, as RAT kept old ticketing system in parallel with e-ticketing system, in addition to current operation costs related to old ticketing system, the operation costs related to e-ticketing raised.

Raw data and indicator calculation	2011 Ex-post values
Total Operational Costs coming from the trams and buses with e-ticketing system(detalied operating costs are shown in the annex 1)	39’860.12 €
Total km traveled by the 80 buses with e- ticketing system	3’681’844 Km
Total km traveled by the 27 trams with e- ticketing system	524’251 Km
Average operating cost	0.0094 €/vkm
Raw data and indicator calculation	**2012 Ex-post values**
Total Operational Costs coming from the trams and buses with e-ticketing system(detalied operating costs are shown in the annex 1)	40’613.26 €
Total km traveled by the 80 buses with e- ticketing system	3’264’988 Km
Total km traveled by the 27 trams with e- ticketing system	533’341 Km
Average operating cost	0.0107 €/vkm

Note: the operation costs include internet conection, energy, administartiv and supplies costs.

Average operating costs (€/vKm)	2009	2010	2011	2012
ex-ante	0.0031			
BAU	0.0031	0.0061	0.0065	0.0072
ex-post	0.0031	0.0061	0.0095	0.0107

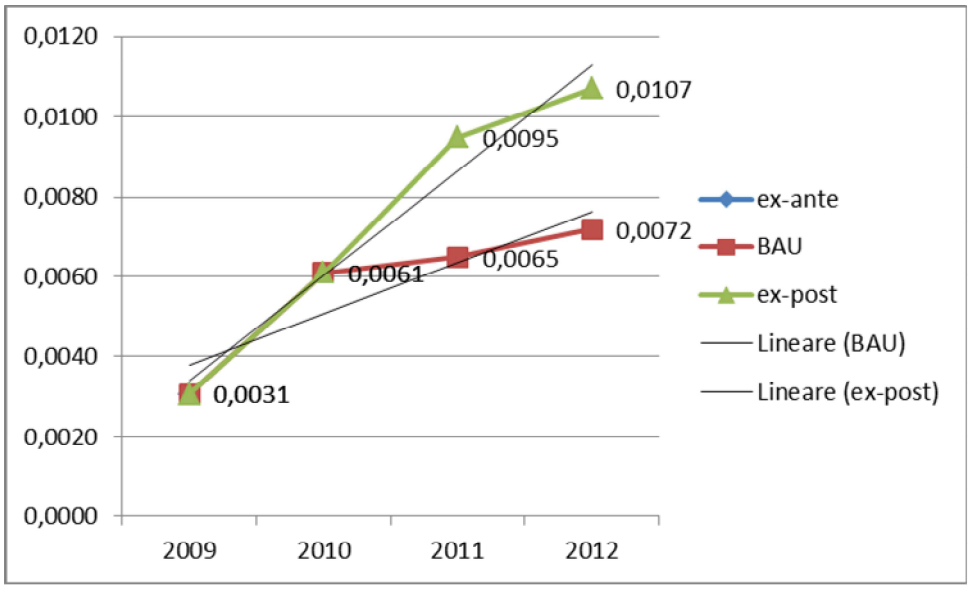


Fig. C2.1.5 – Evolution of average operating costs

Total capital cost

Investment in e-ticketing system:

Indicators and respective parameters	2011 Ex-post values
Investment in the purchase of the e-ticketing system	401’484 €
Total capital cost	401’484 €

Percentage of fraudulent travellers

The routs were monitored for 1 month – in September 2011, and September 2012 durig similar days.

Monitoring people of RAT organised checks in buses and trams and recorded the fraudulent travellers. The percentages of fraudulent people are related to total number of passengers.

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Buses and trams lines monitored	2011 ex-post values
E- 1T	6%
E-1 R	7%
Line 9	4%
Tram line	6%

Buses and trams lines monitored	2012 ex-post values
E- 1T	5%
E-1 R	6%
Line 9	3%
Tram line	5%

Buses and trams lines monitored	Percentage of fraudulent travelers		
	2010	2011	2012
	Ex-ante	Ex-post	Ex-post
E- 1T	7%	6%	5%
E-1 R	8%	7%	6%
Line 9	5%	4%	3%
Tram line	7%	6%	5%

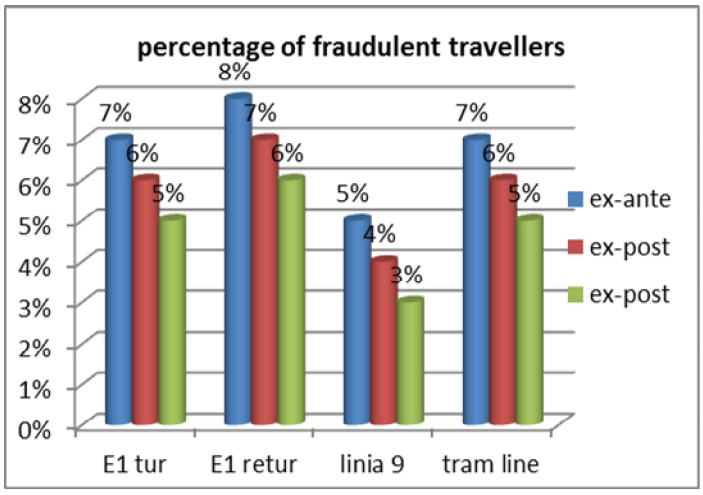


Fig. C2.1.6 – Percentage of fraudolent travellers comparison between ex-ante and ex-post results, by lines

C2.4 Transport

Average occupancy

The indicator was measured in September 2011 and September 2012 to see the trend of the indicator over the system running period.

The data were collected 1 day a week, in peak and off-peak periods.

Buses and trams lines monitored	**maximum number of passengers (100% capacity)**	**Average n. of passengers Average occupancy- off-peak**			**Percentage of passenger**		
		2010	**2011**	**2012**	**2010**	**2011**	**2012**
		Ex-ante	Ex-post	Ex-post	Ex-ante	Ex-post	Ex-post
Line 101- tram line	83	54	37	58	65%	45%	70%
Rout E1T	105	53	43	48	50%	40%	45%
Rout E1 R	105	64	52	58	60%	50%	55%
Rout No. 9	105	63	53	58	60%	50%	55%

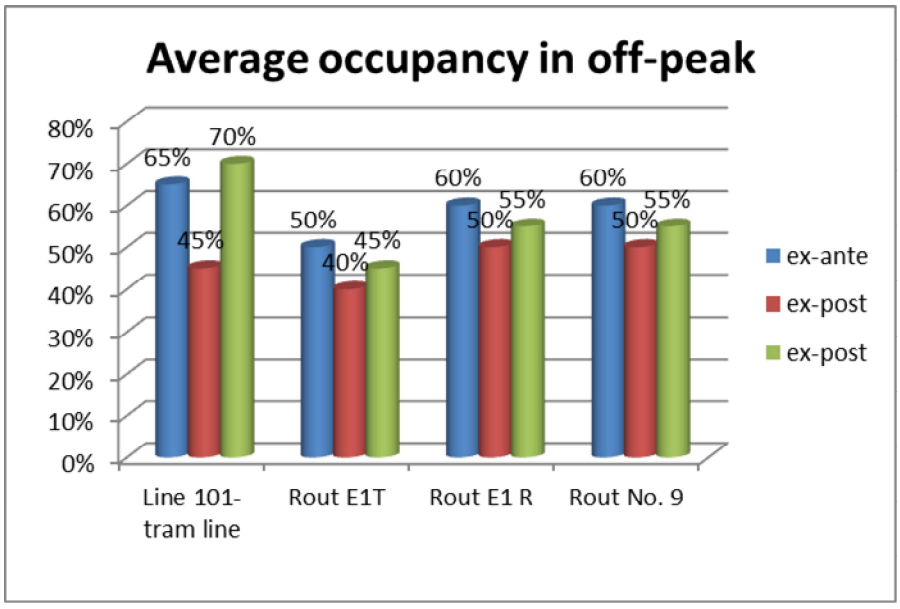


Fig. C2.4.1 – Evolution of average occupancy in off peak

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Buses and trams lines monitored	**maximum number of passengers (100% capacity)**	**Average n. of passengers Average occupancy- peak**			**Percentage of passenger**		
		2010	**2011**	**2012**	**2010**	**2011**	**2012**
		ex-ante	ex-post	ex-post	ex-ante	ex-post	ex-post
Line 101- tram line	83	58	42	62	70%	50%	75%
Rout E1T	105	58	47	53	55%	45%	50%
Rout E1 R	105	68	58	63	65%	55%	60%
Rout No. 9	105	68	58	63	65%	55%	60%

Note: The counting of people was made in several vehicles of the same type.

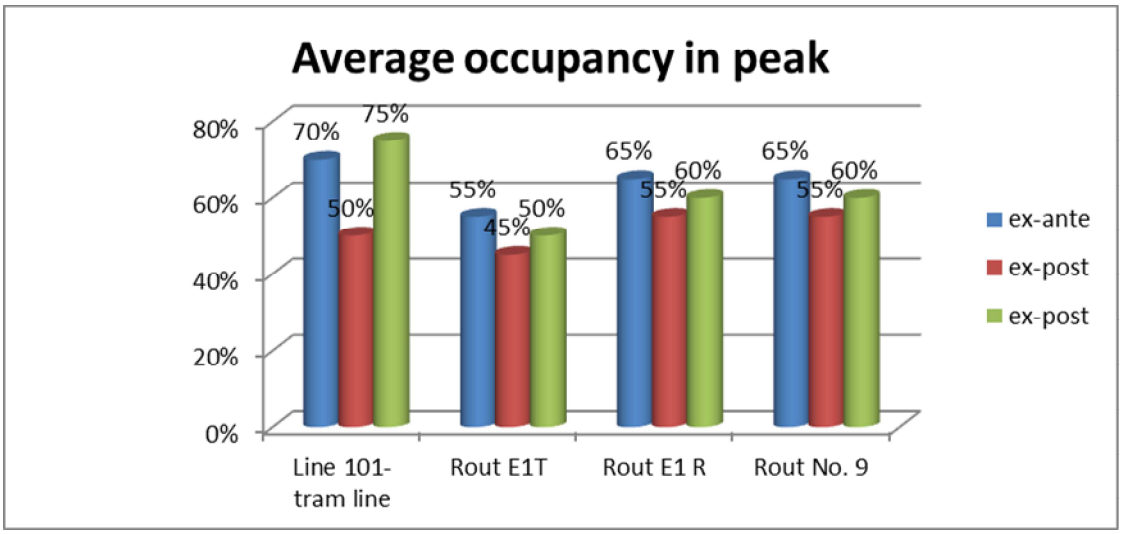


Fig. C2.4.2 – Evolution of average occupancy in peak

In 2011and 2012, average occupancy decreased compared with 2010 because RAT cancelled some discounted season tickets . In 2012, average occupancy increased compared with 2011 but still remained lower than 2010, for buses routs.

For trams, average occupancy decreased in 2011 because of tram line interruption, during overpass construction, but it increased in 2012 more than 2010 and 2011. In August 2012, the construction of overpass finished and the trams operate on whole line, without interruption.

C2.5 Society

Awareness level

The survey was carried out on September 2012, using the same people surveyed for ex-ante evaluation(In agreement with them, their contact data were kept)

160 questioners were circulated by phone and e-mail and 115 feedbacks were received.

Questionaire content	2012 values
Public transport user	85 % yes 3 % No 12 % occasionally
Do you know about the progress of e-ticketing measure?	80% yes 20% no
Do you notice the benefits of the e-ticketing measure in the last time?	88 % yes 10% no 2% do not know

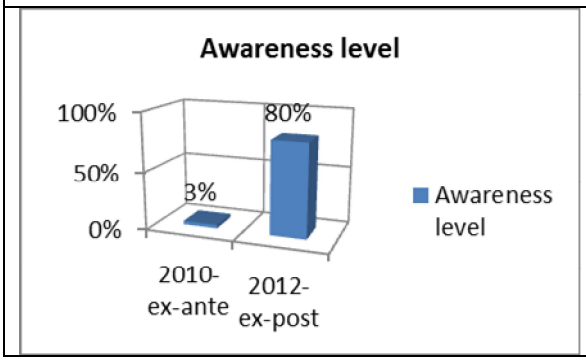
Acceptance level

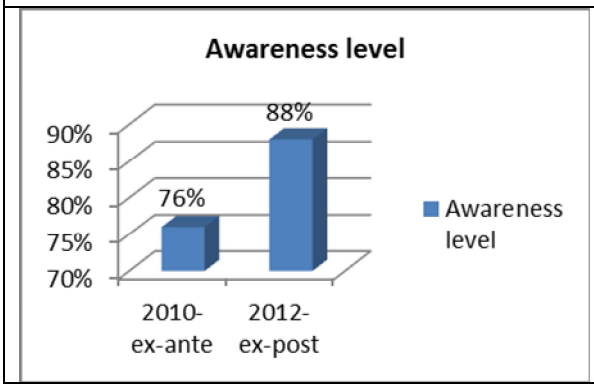
Questionaire content	2012 values
What is your opinion related to electronic validating devices and e-ticketing system?	Less good 14% Good 40% Very good 44 % Don't know 2%
Accept to extend the e-ticketing system to more PT vehicles	Accept 89% Do not accept 10% Do not know 1%

Evolution of indicators **Awareness level and Acceptance level** over the implementation of the measure:

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

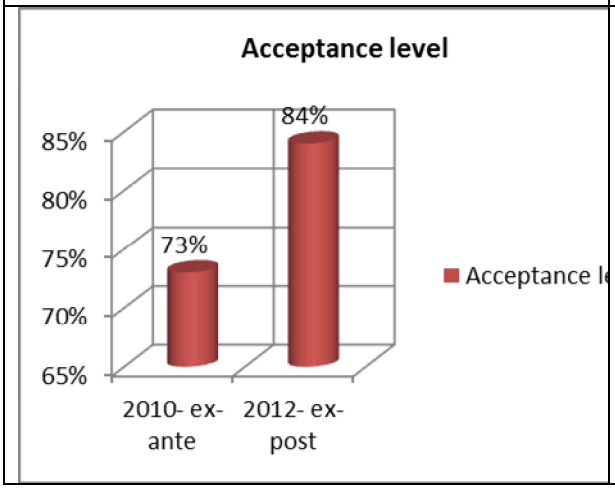
City: Craiova Project: MODERN Measure number: 02.04

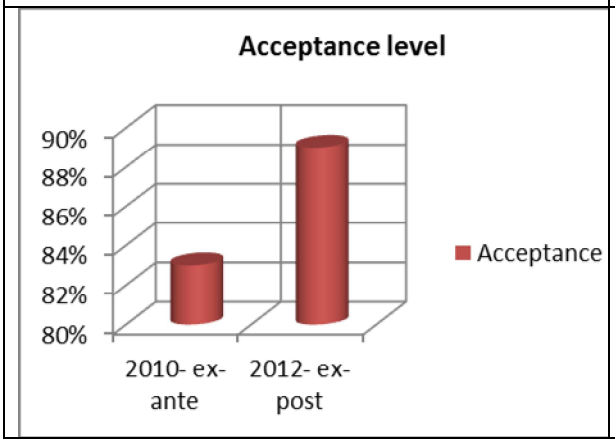
	2010	2012
Indicator /Question	"Do you know the MODERN project and e-ticketing measure ?"	"Do you know about the progress of e-ticketing measure?"
	3%	80%

	2010	2012
Indicator /Question	"Do you understand the aim of the measure and the potential benefit?"	Do you notice the benefits of the e-ticketing measure in the last time?
	76%(well and very well understand	88%(noticed the benefit

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

	2010	2012
Indicator /Question	"What is your opinion related to electronic validating devices and e-ticketing system?"	What is your opinion related to electronic validating devices and e-ticketing system?
	73% (good and very good)	84% (good and very good)

	2010	2012
Indicator /Question	Accept to implement the e-ticketing system	Accept to extend the e-ticketing system to more PT vehicles
	83%	89 %

C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To install e-ticketing system on 80 buses and 27 trams	★★
2	To install 10 automatic ticketing machines in 10 bus stations To install 20 recharging cards set inside of the RAT tickets selling points	★★
3	To increase the average number of passengers with (2-3) % • Average occupancy increased in 2012 by 5% for trams • Average occupancy decreased by 5% for buses	★★ trams O buses
4	To decrease the frauds number passengers by 3% in PT • Fraudulent pessengers decreased by 2 % for buses and trams	★

NA = Not Assessed O = Not Achieved ★ = Substantially achieved (at least 50%) ★★ = Achieved in full ★★★ = Exceeded

C4 Up-scaling of results

RAT is so enthusiast of the e-ticketing system that decide to extend it to the whole company since the beginning of 2013. In order to have good results RAT decided to cancel the mechanical validation system at the beginning of 2015.

C5 Appraisal of evaluation approach

The evaluation of this measure focused on some indicators across the areas of economy, transport and society, which were to be measured in different ways and calculated.

In the evaluation period of measure, some indicators were cancelled for various reasons, such as: there were no available statistics data or these indicators were not relevant to assess the impact of the measure on transportation mode in Craiova. So, the Modal split indicator was cancelled because no ex-ante statistic data available. Also, the indicators related to fuel efficiency, emissions, quality of service and vehicles speed have been cancelled because they were no relevant for measure evaluation.

Calculation of Average operating revenue indicator was difficult, both before and after implementation of the measure, since RAT was unable to collect revenues separately by transportation modes and routes. In addition, after the e-ticketing system implementation on 80 buses and 27 trams, mechanical ticketing system worked in parallel with e-ticketing system.

The e-ticketing system implemented in Craiova through the CIVITAS MODERN project is a pilot e-ticketing system that allows gradual transition from paper tickets to electronic cards. This is the reason why the mechanical devices for paper tickets were kept on lines where electronic validation devices were installed.

Because of the late implementation of the measure, the operations started only in the last months of year 2011 and only 269 cards were sold; In 2012 , the number of sold cards was very low, only 1.317

This low number of cards sold can be explained by the fact that the people are accustomed to using paper tickets instead of cards, since the vehicles operate both with e-ticketing and mechanical validation system. It seems the transition from paper tickets to electronic cards is very slow

The revenues strictly related to electronic cards sold in the evaluation period are 1574,42 € in 2011 and 10.225,58 € in 2012. Obviously, the operating costs cannot be covered by revenues only from selling cards.

So it is very difficult to make a complete evaluation for such a starting system and performing a CBA does not make sense

A really evaluation and CBA should be made when RAT will change the mechanical validation system in the vehicles connected to e-ticketing in order to have a clear picture of the revenues by lines.

It can be said that Rat is so enthusiast of the system that decide to extend e- ticketing to the whole company since the beginning of 2013,and to quit all the paper system at the beginning of 2015

Although the measure brings increased operation and maintenance costs, RAT will have qualitative benefits, such as:

- Possibility of real time transmitting of the data about passengers profile, necessary to RAT management,
- Collection of money in advance
- Limiting the fraudulent passengers
- Possibility to integrate 2 transportation systems (electric and road), in a common ticketing system

C6 Summary of evaluation results

The key results are as follows:

- **Key result 1 - capital and operating costs** – As expected, capital and average operating cost increased as result of the implementation of the measure, although the contribute of the measure to the increase in the average operating cost has been little.
- **Key result 2- percentage of fraudulent people –** The implementation of the measure resulted in the decrease of the percentage of fraudulent people on the routs monitored by 2% for buses and trams.
- **Key result 3 - Average occupancy –** increased for trams by 5% but decreased for buses routs by 5%.
- **Key result 4 - Awareness level –** increased from 3% to 80% related to knowing measure and from 76 % to 88 % related to the befetits of the measure.
- **Key result 5 - Acceptance level**- increased from 83% to 89%.
- New technologies use is mandatory to renew the Public transport operation; among them the e-ticketing system is one of the key operations.

- The full deployment of e ticketing requires important efforts in communications and long time, this explain why, within the first two year only about 2.000 cards were sold. RAT is going to decide a new communication campaign.
- To organize a full shift to e ticketing, a full deployment of the system is needed; RAT decided for a full implementation within the next two years.
- The advantages for PT operator seems to be very relevant in term of knowledge of origin – destination of passengers, passengers on each line, so allowing a new revision of the whole PT network.
- The cooperation within Modern partners (specially Brescia but even Coimbra) who developed similar approaches was a success factor in the deployment of this measure.

C7 Future activities relating to the measure

The results of the measure will be further disseminated inside of country and in the neighboring countries Bulgaria, Slovakia, Albania and Macedonia in different events, economic missions or partnerships between cities.

D Process Evaluation Findings

D.0 Focused 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????*

	0	No focussed measure
2	1	Most important reason
4	2	Second most important reason
8	3	Third most important reason

D.1 Deviations from the original plan

The deviations from the original plan comprised:

- **Deviation 1** –I*mplementation of the e-ticketing system on trams* was delayed

6 months delay in implementation of the measure occurred because the e-ticketing providing company has not delivered the software for the 27 trams on-board computers to integrate them in e-ticketing system. The reason why this happened was RAT had no budget to pay the e-ticketing system provider according to the agreement. When RAT received money from Municipality, the provider was paid and e-ticketing system was fully implemented.

D.2 Barriers and drivers

D.2.1 Barriers

Preparation phase

- **Problem related barriers:** The measure leader and the team spent additional time in research activity for finding most appropriate technical solution that could make the best transition from paper tickets to chip cards (contact-less).
- **Planning barriers,** Large number of producers, different technologies and system components made difficult to estimate the overall system price.

- **Financial barriers**, Delay of Municipality in introducing the RAT co-financing in their budget.

Implementation phase

- **Institutional barriers**: Complexity of Romanian tender procedures
- **Planning barriers** The period for tender was very long because of contestations, so the implementation of e-ticketing system was delayed.
- **Financial barriers**, Delay of Municipality in introducing the RAT co-financing in their budget.

Operation phase

- **Spatial barriers** The measure was slightly delayed for trams and was completed in due time only for buses. The delay was due to the construction of an overpass which led to the division of the tramline into two isolated sections and trams were divided to run on the two sections during the construction.
- **Financial barriers** The budget for payment the company providing e-ticketing system was not available
- **Problem related barriers** The company providing e-ticketing system has not collaborated and blocked the software writing for onboard computer of the 27 trams. In these circumstances, the measure has been delayed for 6 months.

D.2.2 Drivers

Preparation phase

- **Positional drivers** Implementation team was supported by Brescia team concerning on e-ticketing system. So, research activities were made easier using similar experience from partners.

Implementation phase

- **Positional drivers** Implementation team was supported by Brescia team concerning on e-ticketing system. So, implementation activity was made easier using similar experience from partners.
- **Financial drivers** CIVITAS funding has been essential for activate the budget activation

Operation phase

- **Organizational drivers**, IPA's research team is professional and there was a strong and clear leadership. The measure leader is professional and highly motivated person to implement an e-ticketing system

D.2.3 Activities

Preparation phase

- **Involvement / communication actions**, The measure leader organized round table with key stakeholders sharing different viewpoints. The measure leader and the team organize face-to face interviews with potential producers of e-ticketing systems components.
- **Organizational actions** Meetings of the measure team with RAT top management to emphasize the importance of the measure to obtain their maximum facilitating support.
- **Technological actions** The research team made use of city of Brescia experience to improve their knowledge on e-ticketing protocols and systems in order to make easier the implementation of e-ticketing in Craiova.

Implementation phase

- **Positional actions** RAT Company and city of Brescia closed a collaboration agreement in order to transfer the e-ticketing technology
- **Planning actions** Evaluation team for offers tried to be very quick to recover the wasted time with tender procedures
- **Financial actions** Preparation of a new-year-2010 budget plan by the Municipality to consider the co-financing to RAT.
- **Technological actions** The research team made use of city of Brescia experience to improve their knowledge on e-ticketing protocols and systems in order to make easier the implementation of e-ticketing in Craiova.

Operation phase

- **Planning actions,** Actions to recovery the 6 months delay: organization and planning of assembly / installation of on board equipment and of the traffic tracking system for trams operating in the section where doesn't exist intervention workshop. At the same time have been accelerated the activities to connect trams with the central management system from RAT headquarter.
- **Financial actions** The Municipality found budget for payment the company providing e-ticketing system

D.3 Participation

D.3.1. Measure Partners

- **Measure partner 1** – IPA SA - Leading role

IPA SA is a 47 years old Romanian industrial R & D company and is the Romanian national institute for research and development, engineering in energy, automation and IT, with a large experience in European projects in technology transfer and in information dissemination.

IPA was responsible for the dissemination activities and carrying out the research activity and technical studies in the measure. Since 2011 IPA took over the evaluation activity.

- **Measure partner 2** – RAT – Principle participant

RAT Craiova is main Public Transportation Company in Dolj county. It provides the citizen transportation by trams, buses and micro-buses.

RAT Craiova was responsible for the technical specification, acquisition and installation of the e-ticketing system, as well as the training of trams and buses drivers. Also, RAT managed the operation and monitoring activities.

- **Measure partner 3** – LCM – Occasional participant

The Local Council of Craiova Municipality (Primaria Municipiului Craiova) was organized and functions according to Law No. 215/2001 regarding Local Public Administration with the subsequent modification and completion.

Municipality as local government institution has, under the conditions imposed by the public administration law, the decisional right in all matters of local interest: political, social, cultural, educational and technical. Through their structures, the municipality is a complex mechanism which can produce major changes in the quality of urban life under an effective management and coordination.

The competencies of these bodies related to the project covers both the services provided to the local community (i.e. Public transport service in various forms) and the technical interventions (the urban infrastructure, constructions) that together change the image of the city and bring added value to the quality of life in the areas where they act.

LCM was the coordinator of the project since 2009 and assumed the responsibility for the management activity in the MODERN project. Between 2009-2011, LCM carried out the evaluation activity in the project.

D.3.2 Stakeholders

Stakeholder 1 – Alien Concept Company – The company that provided, installed and tested the e-ticketing system. The Alien Concept SRL company specializes in designing automated solutions, thus a major part of its products is customized to the specific needs of each client.

Their product portfolio includes:

- ticket and subscriptions slot machines;
- ticket validators;
- parking ticket slot machines;
- pedestrian and automotive access control systems;

- GPS tracking solutions for managing the transport fleet;
- embedded control systems of patrol;
- electronic information panels.

Stakeholder 2 – **Local Police** – activities to reduce fraudulent passengers.

Stakeholder 3 – Associations of retired people - monthly urban transport subscription, using e-ticketing cards.

Stakeholdre 4 – Students - monthly urban transport subscription, using e-ticketing cards.

D.4 Recommendations

D.4.1 Recommendations: measure replication

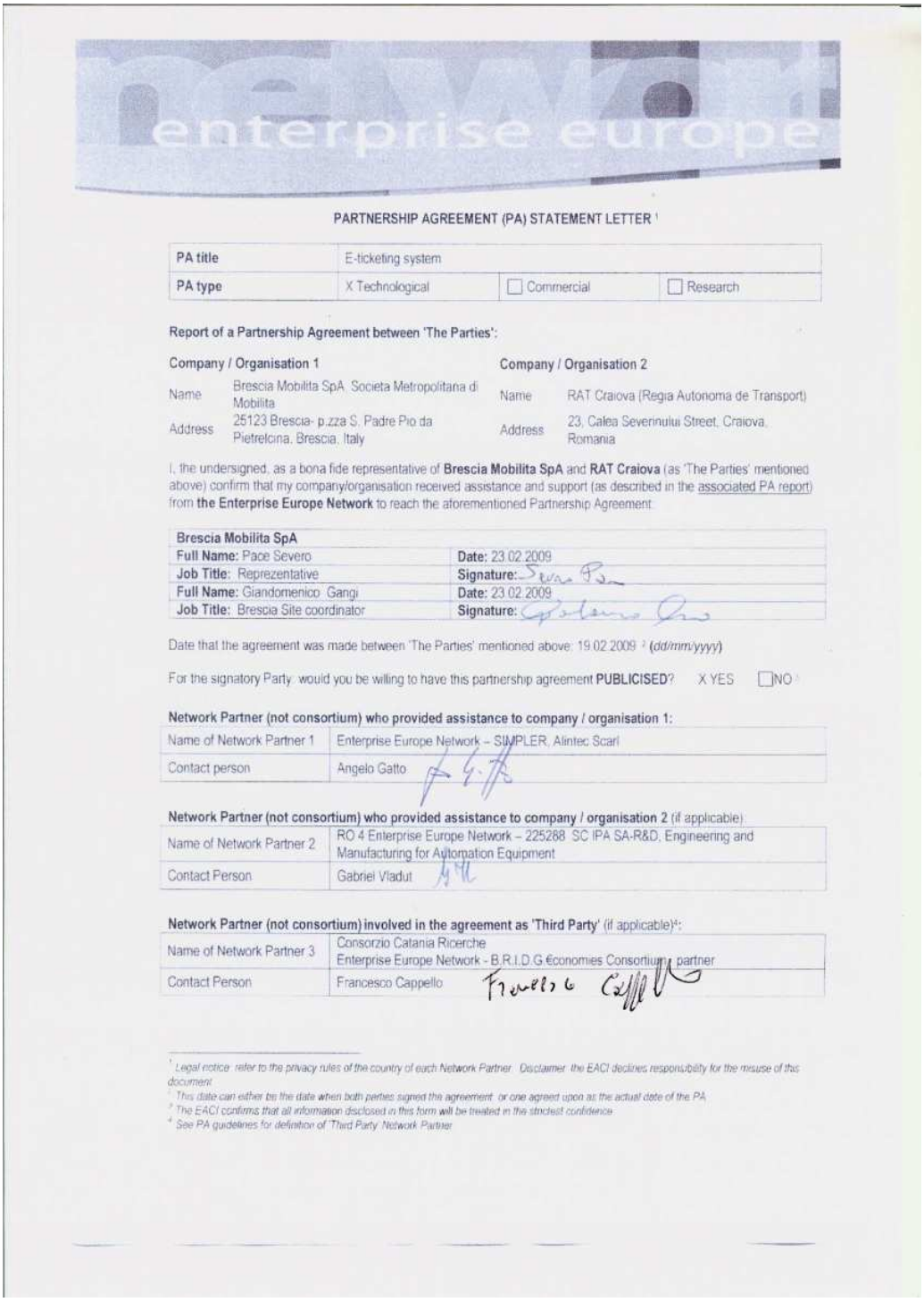
- **Recommendation 1 -** Different view points could facilitate to find out the best solution for satisfying the e-ticketing requirements
- **Recommendation 2** – Using other European cities good practices and experiences lead to achieve a successful implementation of the measure

D.4.2 Recommendations: process (related to barrier-, driver- and action fields)

- **Recommendation 1 -** The measure leader and the team have to organize face-to face interviews with potential producers of e-ticketing systems components.

- **Recommendation 2** – Discussions on e-ticketing requirements among different stakeholders to well understand their requests and expectations. The discussions permitte to focus on a proper design.

Annex 1 – Technological Transfer protocol between Brescia Mobilita and RAT Craiova



enterprise europe

PARTNERSHIP AGREEMENT (PA) STATEMENT LETTER [1]

PA title	E-ticketing system		
PA type	X Technological	☐ Commercial	☐ Research

Report of a Partnership Agreement between 'The Parties':

Company / Organisation 1		**Company / Organisation 2**	
Name	Brescia Mobilita SpA Societa Metropolitana di Mobilita	Name	RAT Craiova (Regia Autonoma de Transport)
Address	25123 Brescia- p.zza S. Padre Pio da Pietrelcina, Brescia, Italy	Address	23, Calea Severinului Street, Craiova, Romania

I, the undersigned, as a bona fide representative of **Brescia Mobilita SpA** and **RAT Craiova** (as 'The Parties' mentioned above) confirm that my company/organisation received assistance and support (as described in the associated PA report) from **the Enterprise Europe Network** to reach the aforementioned Partnership Agreement.

Brescia Mobilita SpA	
Full Name: Pace Severo	**Date:** 23.02.2009
Job Title: Reprezentative	**Signature:**
Full Name: Giandomenico Gangi	**Date:** 23.02.2009
Job Title: Brescia Site coordinator	**Signature:**

Date that the agreement was made between 'The Parties' mentioned above: 19.02.2009 [2] **(dd/mm/yyyy)**

For the signatory Party, would you be willing to have this partnership agreement **PUBLICISED**? X YES ☐NO [3]

Network Partner (not consortium) who provided assistance to company / organisation 1:

Name of Network Partner 1	Enterprise Europe Network – SIMPLER, Alintec Scarl
Contact person	Angelo Gatto

Network Partner (not consortium) who provided assistance to company / organisation 2 (if applicable):

Name of Network Partner 2	RO 4 Enterprise Europe Network – 225288 SC IPA SA-R&D, Engineering and Manufacturing for Automation Equipment
Contact Person	Gabriel Vladut

Network Partner (not consortium) involved in the agreement as 'Third Party' (if applicable)[4]:

Name of Network Partner 3	Consorzio Catania Ricerche Enterprise Europe Network - B.R.I.D.G.economies Consortium, partner
Contact Person	Francesco Cappello

[1] *Legal notice: refer to the privacy rules of the country of each Network Partner. Disclaimer: the EACI declines responsibility for the misuse of this document.*
[2] *This date can either be the date when both parties signed the agreement, or one agreed upon as the actual date of the PA.*
[3] *The EACI confirms that all information disclosed in this form will be treated in the strictest confidence.*
[4] *See PA guidelines for definition of 'Third Party' Network Partner.*

Annex 2 – Costs calculation

	Cases for comparison	internet communication costs (euro)	energy costs(euro)	personal costs	maintenance and spare parts costs (euro)	other costs(indirect costs) 20 % of personel costs(euro)	Supplies costs (plastic cards , writing cards tonner, paper tickets etc) (euro)	Total costs
2009	CIVITAS measure	0.00	0.00	2537.85	0.00	507.57	8726.00	11771.42
	BAU	0.00	0.00	2537.85	0.00	507.57	8726.00	11771.42
2010	CIVITAS measure	0.00	3.60	8804.44	0.00	1760.89	16726.00	27294.93
	BAU	0.00	3.60	8804.44	0.00	1760.89	16726.00	27294.93
2011	CIVITAS measure	2381.00	41.86	18523.55	0.00	3704.71	15209.00	39860.12
	BAU	0.00	3.60	8804.44	0.00	1760.89	16726.00	27294.93
2012	CIVITAS measure	2671.00	34.00	18523.55	0.00	3704.71	15680.00	40613.26
	BAU	0.00	3.60	8804.44	0.00	1760.89	16726.00	27294.93

		No of buses and trams	Km traveled by 80 buses	Km travelled by trams fleet- 27 trams	Average cost/vKm
2009	CIVITAS measure	107	2945536	893497	0.0030662
	BAU	107	2945536	893497	0.0030662
2010	CIVITAS measure	107	3665503	819643	0.0060856

	BAU	107	3665503	819643	0.0060856
2011	CIVITAS measure	107	3681844	524251	0.0094768
	BAU	107	3681844	524251	0.0064894
2012	CIVITAS measure	107	3264988	533341	0.0106924
	BAU	107	3264988	533341	0.007186

Km traveled by buses endowed with e-ticketing	Km travelled by trams endowed with e-ticketing	years
2945536	893497	2009
3665503	819643	2010
3681844	524251	2011
3264988	533341	2012

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

	internet communication costs	energy costs	personnel costs	maintenance and spare parts costs	other costs	supplies costs (plastic cards, written cards tonner, paper tickets)		Total operating costs(€)
						old ticketing costs	e-ticketing costs	
2009	0	0	2537.85	0.00	507.57	8726.00	0.00	11771.42
2010	0	3.6	8804.44	0.00	2866.09	16726.00	0.00	28400.13
2011	2381	41.86	18523.55	0.00	30081.66	14529.00	680.00	66237.07
2012	2671	34	18523.55	0.00	30081.66	15000.00	680.00	66990.21

Detailed operating costs

Annex 3 – Questionnaires and sample size calculation

Instructions

This survey is part of an European project - MODERN (Mobility, development and reducing energy consumption) and aims to collect your experiences in traveling by buses and trams

This measure aims to implement e-ticketing and GPS/GPRS systems on 80 buses and 27 trams.

E-ticketing System to be applied consists of:

- validation devices installed on buses and trams,
- on-board display was installed on each vehicle,
- 30 ticketing automatic machines(10 automatic machines for paper tickets and recharging cards installed in passengers stations; 20 recharging cards set installed inside of the RAT tickets selling points) and communications equipment that transmit data from sites to RAT dispatcher
- 20 digital panels with real time information

Your answers will be treated confidentially. Thank you for your participation!

Ex-ante questionnaire

M 02.04: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

M08.02 INFOMOBILITY TOOLS FOR FLEET MANAGEMENT IN CRAIOVA

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

1. Gender: F ☐ 35% ☐ M 65 %

2. Age:

Up to 15	15-24	25-45	45-54	55-65	over 65
5%	25%	20%	25%	10%	15%

3. Background (the last education institution graduated):

· faculty	· secondary school	· primary school
35%	60%	5%

4. Labor market status:

employed	unemployed	pensioners
60%	25%	15%

5. Public transport user

80% ☐ yes 5% ☐ no 15% ☐ occasionally

Awareness level

6. Do y**ou know the MODERN project and e-ticketing measures?**

3% ☐ yes 97% ☐ no

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Do y**ou know the MODERN project and GPS?GPRS measures?**

3% ☐ 97%

yes no ☐

7. How important are the following sources of information concerning to e-ticketing and GPS/GPRS system on buses and trams , cards selling points and real time information digital panels ?

	un-important	Rather un-important	Rather important	Very important	I don't know
Transport Company of Craiova- RAT website	☐1	☐2	☐4	☐5	☐6
Media	☐1	☐2	☐4	☐5	☐6
Colleagues/acquaintances	☐1	☐2	☐4	☐5	☐6
Forums or similar on the internet	☐1	☐2	☐4	☐5	☐6
Other, please specify below:	☐1	☐2	☐4	☐5	☐6

8. Do you understand the aim of

- the e-ticketing measure and the potential benefit?

fairly well understand	well understand	very well understand	Don't know
20%	40%	36%	4%

- the GPS/GPRS measure and the potential benefit?

fairly well understand	well understand	very well understand	Don't know
4%	52%	38%	6%

Acceptance level

9. What is your opinion related to

- electronic validating devices and e-ticketing system?

Less good	good	Very good	Don't know
25 %	35%	38%	2%

- GPS system and real time information digital panels

Less good	good	Very good	Don't know
0	10%	80%	10%

10. Willingness to implement the measures:

- e-ticketing system

Accept	Do not accept	Do not know
83 %	15%	2%

- GPS system and real time information digital panels

Accept	Do not accept	Do not know
90%	0	10%

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

11. Which is the reason for that you want to implement the e-ticketing measure ?

☐1	To reduce the tickets selling time	50 %
☐2	A modern travel mode	30%
☐3	Old system is obsolete -	3%

For travellers that accept the measure

12. Which is the reason for that you want to implement the GPS/GPRS measure ?

☐1	A modern travel mode	15%
☐2	Good time management	85%

For travellers that accept the measure

13. Which is the reason for that you do not want to implement the e-ticketing measure ?

☐1	cannot handle e-commerce or any other e- activity	10%
☐2	extra responsibility related to electronic cards	5%

For travellers that do not accept the measure

14. Which is the reason for that you do not want to implement the GPS/GPRS measure ?

☐1	.....
☐2	……..

For travellers that do not accept the measure

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

Instructions

This survey is part of an European project - MODERN (Mobility, development and reducing energy consumption) and aims to collect your experiences in traveling by buses and trams

This measure aims to implement e-ticketing and GPS/GPRS systems on 80 buses and 27 trams.

E-ticketing System to be applied consists of:

- validation devices installed on buses and trams,

- on-board display was installed on each vehicle,

- 30 ticketing automatic machines(10 automatic machines for paper tickets and recharging cards installed in passengers stations; 20 recharging cards set installed inside of the RAT tickets selling points) and communications equipments that transmit data from sites to RAT dispatcher

- 20 digital panels with real time information

Your answers will be treated confidentially.

Thank you for your participation!

Ex-post questionnaire

M 02.04: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

M08.02 INFOMOBILITY TOOLS FOR FLEET MANAGEMENT IN CRAIOVA

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

City: Craiova Project: MODERN Measure number: 02.04

1. Gender: F ☐ 38% ☐ M 62 %

2. Age:

Up to 15	15-24	25-45	45-54	55-65	over 65
3%	30%	25%	26%	6%	10%

3. Background (the last education institution graduated):

faculty	secondary school	primary school
30%	67%	3%

4. Labor market status:

employed	unemployed	pensioners
67%	20%	13%

5. Public transport user

yes ☐ 85% no ☐ 3% occasionally ☐ 12%

Awareness level

6. Do y**ou know about the progress of the e-ticketing measure?**

☐ ☐

80%yes no 20%

Measure title: INTEGRATING E-TICKETING SYSTEM IN CRAIOVA

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Do y**ou know about the progress of GPS/GPRS measure?**

30% yes ☐ no 70% ☐

7. Do you notice the benefits of the e-ticketing measure in the last time?

88% yes ☐ no 10% ☐ 2% don't know ☐

Do you notice the benefits of the GPS/GPRS measure in the last time?

82% yes ☐ no 13% ☐ 5% don't kno ☐

Acceptance level

8. What is your opinion related to

- electronic validating devices and e-ticketing system?

Less good	good	Very good	Don't know
14 %	40%	44%	2%

- GPS system and real time information digital panels

Less good	good	Very good	Don't know
0	15%	80%	5%

9. Accept to keep and extend the e-ticketing system to more PT vehicles:

Accept	Do not accept	Do not know
89 %	10%	1%

Accept to keep and extend the GPS/GPRS system to more PT vehicles:

Accept	Do not accept	Do not know
94%	0	6%

Estimation of sample size

Variables name and explanations		Variables values
n	The sample size	119
t	z-score: the abscissa of the Normal distribution for probability α (consisted of 1.5+0.03 from the table-standard normal probabilities)	1.53
α	**confidence level**, is a percentage and represents how often the true percentage of the population who would pick an answer lies within the **confidence interval** (margin of error).	87.50%
P	percentage of your sample that picks a particular answer. We considered that majority of people will be satisfied if the buses fleet will be replaced with new one	0.85
Q	(1-P)	0.15
d	**confidence interval** (also called margin of error)	0.05
N	population total (if N is enough large the term in the denominator tends to 1 and the formula is reduced to the numerator)	300000

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Standard Normal Probabilities

Source: http://people.richland.edu/james/lecture/m170/tbl-norm.html

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

Annex 4 – Occupancy monitoring

Note relating to meaning the figures in the tables:

- The period 09:00- 10:00 is the period when the data were collected in the morning for off-peak period
- The period 19:00-20:00 is the period when the data were collected in the after-noon for off-peak period
- The period 07:00- 08:00 is the period when the data were collected in the morning for peak period
- The period 15:00- 16:00 is the period when the data were collected in the after-noon for peak period
- Routs monitored includes the following stations:
    - " Electroputere" station-"Piata centrala" station(2 Km lengt- tram line)
    - "Fabrica de confectii " station- "Stadion" Station(1 Km length – E1T rout)
    - "Stadion " station-"Park"station(1 Km length- E1R rout)
    - "Electroputere"station-"Lapus" station(1 Km length- Rout no. 9)
- Maximum number of passengers means the capacity of vehicle:
    - 83 passengers for tram monitored
    - 105 passengers for bus (MAN LC type) monitored

The routs and tram line were monitored for 1 month – September 2010, 2011 and 2012

The passengers travelling between the stations before listed have been counted and the occupancy percentage was calculated as ratio between average number of passengers and maximum capacity of vehicle.

	Average occupancy off-peak hours			09:00-10:00			
Tram	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
Line 101		48	83.00	58%	We Sept 1st		
		52	83.00	63%	Th- Sept 9th		
		46	83.00	55%	Fr- Sept 17th		
		70	83.00	84%	We- Sept 22nd		
	2	48	83.00	58%	Th- Sept 30th	Sept	
							2010

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	Average occupancy in off-peak hours			19:00-20:00			
Tram	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
Line 101		50	83.00	60%	We Sept 1st		
		48	83.00	58%	Th- Sept 9th		
		60	83.00	72%	Fr- Sept 17th		
		51	83.00	61%	We- Sept 22nd		
	2	65	83.00	78%	Th- Sept 30th	Sept	
							2010

	Average occupancy off-peak hours			09:00-10:00			
Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station-"Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		55	105.00	52%	We Sept 1st		
		52	105.00	50%	Th- Sept 9th		
		46	105.00	44%	Fr- Sept 17th		
		48	105.00	46%	We- Sept 22nd		
	1	60	105.00	57%	Th- Sept 30th	Sept	
							2010

	Average occupancy in off-peak hours			19:00-20:00			

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Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station-"Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		40	105.00	38%	We Sept 1st		
		62	105.00	59%	Th- Sept 9th		
		52	105.00	50%	Fr- Sept 17th		
		50	105.00	48%	We- Sept 22nd		
	1	60	105.00	57%	Th- Sept 30th	Sept	
							2010

Line E1R MAN LC bus type	Average occupancy off-peak hours			09:00-10:00			
	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		60	105.00	57%	We Sept 1st		
		55	105.00	52%	Th- Sept 9th		
		60	105.00	57%	Fr- Sept 17th		
		71	105.00	68%	We- Sept 22nd		
	1	68	105.00	65%	Th- Sept 30th	Sept	
							2010

Line E1 R	Average occupancy in off-peak hours			19:00-20:00			
	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year

MAN LC bus type		70	105.00	67%	We Sept 1st		
		60	105.00	57%	Th- Sept 9th		
		68	105.00	65%	Fr- Sept 17th		
		58	105.00	55%	We- Sept 22nd		
	1	65	105.00	62%	Th- Sept 30th	Sept	
							2010

	Average occupancy off-peak hours			09:00-10:00			
Line 9	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
MAN LC bus type		73	105.00	70%	We Sept 1st		
		64	105.00	61%	Th- Sept 9th		
		60	105.00	57%	Fr- Sept 17th		
		68	105.00	65%	We- Sept 22nd		
	1	79	105.00	75%	Th- Sept 30th	Sept	
							2010

	Average occupancy in off-peak hours			19:00-20:00			
Line 9	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
MAN LC bus	1	70	105.00	67%	We Sept 1st	Sept	2010

type							
		67	105.00	64%	Th- Sept 9th		
		50	105.00	48%	Fr- Sept 17th		
		58	105.00	55%	We- Sept 22nd		
		40	105.00	38%	Th- Sept 30th		

	Average occupancy in peak			07:00-08:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		55	83.00	66%	We Sept 1st		
		52	83.00	63%	Th- Sept 9th		
		60	83.00	72%	Fr- Sept 17th		
		64	83.00	77%	We- Sept 22nd		
	2	57	83.00	69%	Th- Sept 30th	Sept	
							2010

	Average occupancy in peak hours			15:00-16:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		50	83.00	60%	We Sept 1st		
		53	83.00	64%	Th- Sept 9th		
	2	60	83.00	72%	Fr- Sept	Sept	2010

					17th		
		67	83.00	81%	We- Sept 22nd		
		65	83.00	78%	Th- Sept 30th		

	Average occupancy in peak hours			07:00-08:00			
Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station-"Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		62	105.00	59%	We Sept 1st		
		52	105.00	50%	Th- Sept 9th		
		58	105.00	55%	Fr- Sept 17th		
		53	105.00	50%	We- Sept 22nd		
	1	60	105.00	57%	Th- Sept 30th	Sept	
							2010

	Average occupancy in peak hours			15:00-16:00			
Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station-"Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		56	105.00	53%	We Sept 1st		
		62	105.00	59%	Th- Sept 9th		
		52	105.00	50%	Fr- Sept 17th		
		57	105.00	54%	We- Sept 22nd		
	1	65	105.00	62%	Th- Sept 30th	Sept	
							2010

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	Average occupancy in peak hours			07:00-08:00			
Line E1R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	68	105.00	65%	We Sept 1st	Sept	2010
		62	105.00	59%	Th- Sept 9th		
		65	105.00	62%	Fr- Sept 17th		
		71	105.00	68%	We- Sept 22nd		
		74	105.00	70%	Th- Sept 30th		

	Average occupancy in peak hours			15:00-16:00			
Line E1 R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	75	105.00	71%	We Sept 1st	Sept	2010
		60	105.00	57%	Th- Sept 9th		
		76	105.00	72%	Fr- Sept 17th		
		58	105.00	55%	We- Sept 22nd		
		73	105.00	70%	Th- Sept 30th		

	Average occupancy in peak hours			07:00-08:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	73	105.00	70%	We Sept 1st	Sept	2010

		68	105.00	65%	Th- Sept 9th		
		65	105.00	62%	Fr- Sept 17th		
		75	105.00	71%	We- Sept 22nd		
		80	105.00	76%	Th- Sept 30th		

	Average occupancy in peak hours			15:00-16:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		74	105.00	70%	We Sept 1st		
		67	105.00	64%	Th- Sept 9th		
		58	105.00	55%	Fr- Sept 17th		
		58	105.00	55%	We- Sept 22nd		
	1	60	105.00	57%	Th- Sept 30th	Sept	2010

	Average occupancy off-peak hours			09:00-10:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		35	83.00	42%	Th Sept 1st		
		45	83.00	54%	Mo- Sept 5th		
		33	83.00	40%	Tu- Sept 13th		
	2	38	83.00	46%	We- Sept 21st	Sept	2011

		34	83.00	41%	Th- Sept 39th		

	Average occupancy in off-peak			19:00-20:00			
Tram type Line 101	Distance travelled " Electroputere" station- "Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		37	83.00	45%	Th Sept 1st		
		41	83.00	49%	Mo- Sept 5th		
		38	83.00	46%	Tu- Sept 13th		
		40	83.00	48%	We- Sept 21st		
	2	33	83.00	40%	Th- Sept 39th	Sept	
							2011

	Average occupancy off-peak hours			09:00-10:00			
Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		38	105.00	36%	Th Sept 1st		
		50	105.00	48%	Mo- Sept 5th		
		49	105.00	47%	Tu- Sept 13th		
		45	105.00	43%	We- Sept 21st		
	1	37	105.00	35%	Th- Sept 39th	Sept	
							2011

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	Average occupancy in off-peak hours			19:00-20:00			
Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	39	105.00	37%	Th Sept 1st	Sept	2011
		47	105.00	45%	Mo- Sept 5th		
		44	105.00	42%	Tu- Sept 13th		
		42	105.00	40%	We- Sept 21st		
		34	105.00	32%	Th- Sept 39th		

	Average occupancy off-peak hours			09:00-10:00			
Line E1R MAN LC bus type	Distance travelled "Stadion " station- "Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	48	105.00	46%	Th Sept 1st	Sept	2011
		55	105.00	52%	Mo- Sept 5th		
		58	105.00	55%	Tu- Sept 13th		
		51	105.00	49%	We- Sept 21st		
		45	105.00	43%	Th- Sept 39th		

	Average occupancy in off-peak hours			19:00-20:00			

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Line E1 R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		60	105.00	57%	Th Sept 1st		
		52	105.00	50%	Mo- Sept 5th		
		55	105.00	52%	Tu- Sept 13th		
		47	105.00	45%	We- Sept 21st		
	1	51	105.00	49%	Th- Sept 39th	Sept	
							2011

	Average occupancy off-peak hours			09:00-10:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		56	105.00	53%	Th Sept 1st		
		60	105.00	57%	Mo- Sept 5th		
		52	105.00	50%	Tu- Sept 13th		
		58	105.00	55%	We- Sept 21st		
	1	42	105.00	40%	Th- Sept 39th	Sept	
							2011

	Average occupancy in off-peak hours			19:00-20:00			
Line 9 MAN LC bus	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	52	105.00	50%	Th Sept 1st	Sept	2011

type							
		57	105.00	54%	Mo- Sept 5th		
		50	105.00	48%	Tu- Sept 13th		
		58	105.00	55%	We- Sept 21st		
		40	105.00	38%	Th- Sept 39th		

	Average occupancy in peak			07:00-08:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		41	83.00	49%	Th Sept 1st		
		52	83.00	63%	Mo- Sept 5th		
		44	83.00	53%	Tu- Sept 13th		
		42	83.00	51%	We- Sept 21st		
	2	38	83.00	46%	Th- Sept 39th	Sept	
							2011

	Average occupancy in peak hours			15:00-16:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		38	83.00	46%	Th Sept 1st		
	2	42	83.00	51%	Mo- Sept 5th	Sept	2011

		44	83.00	53%	Tu- Sept 13th		
		41	83.00	49%	We- Sept 21st		
		37	83.00	45%	Th- Sept 39th		

	Average occupancy in peak hours			07:00-08:00			
Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		40	105.00	38%	Th Sept 1st		
		50	105.00	48%	Mo- Sept 5th		
		40	105.00	38%	Tu- Sept 13th		
		53	105.00	50%	We- Sept 21st		
	1	43	105.00	41%	Th- Sept 39th	Sept	
							2011

	Average occupancy in peak hours			15:00-16:00			
Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		45	105.00	43%	Th Sept 1st		
		55	105.00	52%	Mo- Sept 5th		
		52	105.00	50%	Tu- Sept 13th		
		50	105.00	48%	We- Sept 21st		
	1	46	105.00	44%	Th- Sept 39th	Sept	2011

	Average occupancy in peak hours			07:00-08:00			
Line E1R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	61	105.00	58%	Th Sept 1st	Sept	2011
		60	105.00	57%	Mo- Sept 5th		
		55	105.00	52%	Tu- Sept 13th		
		55	105.00	52%	We- Sept 21st		
		60	105.00	57%	Th- Sept 39th		

	Average occupancy in peak hours			15:00-16:00			
Line E1 R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	61	105.00	58%	Th Sept 1st	Sept	2011
		60	105.00	57%	Mo- Sept 5th		
		51	105.00	49%	Tu- Sept 13th		
		58	105.00	55%	We- Sept 21st		
		60	105.00	57%	Th- Sept 39th		

	Average occupancy in peak hours			07:00-08:00			

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Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	51	105.00	49%	Th Sept 1st	Sept	2011
		65	105.00	62%	Mo- Sept 5th		
		60	105.00	57%	Tu- Sept 13th		
		62	105.00	59%	We- Sept 21st		
		55	105.00	52%	Th- Sept 39th		

	Average occupancy in peak hours			15:00-16:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	60	105.00	57%	Th Sept 1st	Sept	2011
		61	105.00	58%	Mo- Sept 5th		
		58	105.00	55%	Tu- Sept 13th		
		58	105.00	55%	We- Sept 21st		
		52	105.00	50%	Th- Sept 39th		

	Average occupancy off-peak hours			09:00-10:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	2	58	83.00	70%	Mo Sept 3rd	Sept	2012

		52	83.00	63%	Tu- Sept 11th		
		48	83.00	58%	We- Sept 19th		
		70	83.00	84%	Mo- Sept 24th		
		60	83.00	72%	Fr- Sept 28th		

	Average occupancy in off-peak hours			19:00-20:00			
Tram Line 101	Distance travelled " Electroputere" station- "Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		50	83.00	60%	Mo Sept 3rd		
		55	83.00	66%	Tu- Sept 11th		
		60	83.00	72%	We- Sept 19th		
		60	83.00	72%	Mo- Sept 24th		
	2	70	83.00	84%	Fr- Sept 28th	Sept	
							2012

	Average occupancy off-peak hours			09:00-10:00			
Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		50	105.00	48%	Mo Sept 3rd		
		52	105.00	50%	Tu- Sept 11th		
		46	105.00	44%	We- Sept 19th		
		48	105.00	46%	Mo- Sept 24th		
	1	51	105.00	49%	Fr- Sept	Sept	2012

					28th		

	Average occupancy in off-peak hours			19:00-20:00			
Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		38	105.00	36%	Mo Sept 3rd		
		50	105.00	48%	Tu- Sept 11th		
		51	105.00	49%	We- Sept 19th		
		47	105.00	45%	Mo- Sept 24th		
	1	44	105.00	42%	Fr- Sept 28th	Sept	
							2012

	Average occupancy off-peak hours			09:00-10:00			
Line E1R MAN LC bus type	Distance travelled "Stadion " station- "Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		59	105.00	56%	Mo Sept 3rd		
		50	105.00	48%	Tu- Sept 11th		
		60	105.00	57%	We- Sept 19th		
		65	105.00	62%	Mo- Sept 24th		
	1	55	105.00	52%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in off-peak hours			19:00-20:00			

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Line E1 R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	63	105.00	60%	Mo Sept 3rd	Sept	2012
		60	105.00	57%	Tu- Sept 11th		
		61	105.00	58%	We- Sept 19th		
		52	105.00	50%	Mo- Sept 24th		
		57	105.00	54%	Fr- Sept 28th		
	Average occupancy off-peak hours			09:00-10:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	62	105.00	59%	Mo Sept 3rd	Sept	2012
		64	105.00	61%	Tu- Sept 11th		
		60	105.00	57%	We- Sept 19th		
		68	105.00	65%	Mo- Sept 24th		
		57	105.00	54%	Fr- Sept 28th		
	Average occupancy in off-peak hours			19:00-20:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	61	105.00	58%	Mo Sept 3rd	Sept	2012

		60	105.00	57%	Tu- Sept 11th		
		50	105.00	48%	We- Sept 19th		
		58	105.00	55%	Mo- Sept 24th		
		40	105.00	38%	Fr- Sept 28th		
	Average occupancy in peak			07:00-08:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		64	83.00	77%	Mo Sept 3rd		
		52	83.00	63%	Tu- Sept 11th		
		60	83.00	72%	We- Sept 19th		
		64	83.00	77%	Mo- Sept 24th		
	2	70	83.00	84%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in peak hours			15:00-16:00			
Tram Line 101	Distance travelled " Electroputere" station-"Piata centrala" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		61	83.00	73%	Mo Sept 3rd		
		53	83.00	64%	Tu- Sept 11th		
		60	83.00	72%	We- Sept 19th		
		67	83.00	81%	Mo- Sept 24th		
	2	70	83.00	84%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in peak hours			07:00-08:00			

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Line E1T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		58	105.00	55%	Mo Sept 3rd		
		52	105.00	50%	Tu- Sept 11th		
		55	105.00	52%	We- Sept 19th		
		53	105.00	50%	Mo- Sept 24th		
	1	50	105.00	48%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in peak hours			15:00-16:00			
Line E1 T MAN LC bus type	Distance travelled "Fabrica de confectii " station- "Stadion" Station (Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		50	105.00	48%	Mo Sept 3rd		
		60	105.00	57%	Tu- Sept 11th		
		52	105.00	50%	We- Sept 19th		
		50	105.00	48%	Mo- Sept 24th		
	1	49	105.00	47%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in peak hours			07:00-08:00			
Line E1R MAN LC	Distance travelled "Stadion " station- "Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
	1	58	105.00	55%	Mo Sept 3rd	Sept	2012

bus type							
		62	105.00	59%	Tu- Sept 11th		
		65	105.00	62%	We- Sept 19th		
		65	105.00	62%	Mo- Sept 24th		
		60	105.00	57%	Fr- Sept 28th		

	Average occupancy in peak hours			15:00-16:00			
Line E1 R MAN LC bus type	Distance travelled "Stadion " station-"Park"station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		68	105.00	65%	Mo Sept 3rd		
		60	105.00	57%	Tu- Sept 11th		
		71	105.00	68%	We- Sept 19th		
		58	105.00	55%	Mo- Sept 24th		
	1	67	105.00	64%	Fr- Sept 28th	Sept	
							2012

	Average occupancy in peak hours			07:00-08:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		67	105.00	64%	Mo Sept 3rd		
		68	105.00	65%	Tu- Sept 11th		
	1	65	105.00	62%	We- Sept 19th	Sept	2012

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		70	105.00	67%	Mo- Sept 24th		
		63	105.00	60%	Fr- Sept 28th		

	Average occupancy in peak hours			15:00-16:00			
Line 9 MAN LC bus type	Distance travelled "Electroputere"station-"Lapus" station(Km)	average no of passengers	maximum number of passengers	Average occupancy	day	month	year
		65	105.00	62%	Mo Sept 3rd		
		60	105.00	57%	Tu- Sept 11th		
		58	105.00	55%	We- Sept 19th		
		58	105.00	55%	Mo- Sept 24th		
	1	60	105.00	57%	Fr- Sept 28th	Sept	
							2012