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*Measure title:* **CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA**

*City:* **Brescia**

*Project:* **MODERN**

*Measure number:* **01.06**

## **M01.06 – Executive summary**

The main purpose of this measure was to renew the Local Public Transport (LPT) fleet, purchasing new clean and energy efficient vehicles. The measure foresaw a series of actions aimed at improving LPT both from the emissions and the service offer to citizens point of view, trying to solve the problems related to the busses overcrowding, increasing the fleet punctuality and then increasing the number of passengers offering more comfortable vehicles.

The new vehicles (which substitute the older ones) were activated on the bus line n.1, which crosses the city from north to south, serving the most important university poles, many schools, the train and the extra-urban bus stations, where the main criticalities were detected. The measure mainly consists of actions related to the purchase and the equipment of the new busses. Specific actions were addressed to the bus drivers, in order to increase their awareness about the new vehicles (especially the 18 m long ones) which represent an absolute novelty for the city of Brescia, from the technical and the driving point of view (as a matter of fact, many problems are related to the difficulties in driving the new 18 m vehicles on the roundabouts). Other specific activities concerned the dissemination about the actions implemented within the measure.

In order to evaluate the objective achievement, a set of indicators were collected to monitor the objective achievements, to check the environmental care, to evaluate the pollutant emissions and to know the accuracy of time keeping and the average occupancy.

The general goal to renew the fleet was exceeded thanks to the implementation of coordinated actions such as the CNG vehicles purchase (45% of the fleet in 2008; 59% in 2011), their introduction into the bus network (54,86% of km travelled in 2008; 73,37% in 2011) and the promotional campaigns which let citizens know about the new service and its advantages.

In order to replicate elsewhere the measure, it would be important to highlight the necessity of a strong integration among the measure implementation, the information campaigns and the measure monitoring, in order to make users aware of the reasons why the actions are undertaken (for example, a good level of information about the initiative carried out in Line 1 was important for users in order to make them understand the reduction of buses frequency and not to see this choice as a worsening of public transport service).

Another important issue was the direct involvement of stakeholders (namely the citizens of the city of Brescia), also through a massive dissemination campaign, in order to widespread information throughout the Brescia territory.

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## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(A) High level / longer term:

- To reduce air pollution, exhaust gases and noise;
- To increase the use of alternative fuels.

(B) Strategic level:

- To make public transport fleet more efficient and also more comfortable and suitable for an on demand transport system

(C) Measure level:

- (1) To increase the weight of the CNG (methane gas powered) fleet in order to reduce emission from Public Transport vehicles by purchasing 40 new CNG buses – that is up to 25% of the whole fleet – and 3 CNG busses for on-demand transport services);
- (2) To keep the fleet average age younger than 8 years;
- (3) To minimize the buses' overcrowding in the bus lines crossing the old town and, at the same time, reduce the service frequency by substituting the 12m buses in operation with CNG 18m ones. This can lead to an increase in number of available seats even if the total number of trips of a certain bus line is decreased;
- (4) To improve accuracy of time keeping ;
- (5) To increase the number of passengers by 5% in the demo area;
- (6) To increase the km covered by CNG bus by more than 60%.

### **A2 Description**

The city of Brescia has decided to implement the measure in order to increase the quality level of transport system according to the local transport company BST<sup>1</sup> strategic level policy to improve the fleet quality with less pollutant and more comfortable vehicles. The measure objectives have then be accomplished through a PT fleet renovation based on existing available technologies. Hence, the main target of the measure is to increase the quality and the effectiveness of the public transport system both from an environmental and a service point of view.

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<sup>1</sup> BST: Brescia Trasporti.

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In the first phase of project implementations the new vehicles introduced in the PT fleet for substituting the older ones were addressed to cover the Line 1 (Fig. 1).



Fig. 1 The Line 1 network in Brescia

This line crosses the city from north to south, passing through the historical centre. It links the most important territorial services of the city (such as the hospital and the University – Engineering and Medicine Faculties) that are located in the northern part of Brescia while the railway station and the suburban bus station are placed in the southern part of the city, just outside the historical centre. This line is also used by students of several high schools in Brescia.

The line can be considered critical from several points of view. Firstly, to respond to the high transport demand there is a high frequency of busses (about 1 bus every 5 minutes), and as a consequence “bus queuing” problems have emerged. Additionally, there is an overcrowding problem with a consequent low quality of service, that has become unsustainable from the customer point of view during peak hours (8.106.965 passengers transported in year 2008). Moreover, bus equipment needed to be modified due to overcrowding problems.

The envisaged solution has then been to introduce 18m busses, and so increasing the capacity from 92 seats (Irisbus model) or 98 (Breda model) to 149 seats / bus. In this way it is possible to reduce the number of trips and, at the same time, to keep an efficient service.

During the measure implementation, it has been faced an economic restraint that led to a decrease in the number of purchased buses, which came out to be the following:

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- n.20, 18mt nCNG;
- n.6, 12mt CNG; (other 6 12m long CNG buses have already been ordered by BST, but they haven't been put into service yet. Furthermore, 3 of them have already been delivered);
- n.6, 8mt busses (of which 2 CNG and 4 Hybrids methane gas-electric).

Finally, among the new purchased buses, 2 of the 8mt long ones (hybrids) have been dedicated to the 'on demand' service addressed to disabled people (the service is called Accabus and is object of another Civitas Measure<sup>2</sup>), while the other 8mt buses have been used for ordinary PT service (for more details see the section B of this document).

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<sup>2</sup> M06.02 – 'On-demand PT service in Brescia'.

## **B. Measure implementation**

### **B1 Innovative aspects**

The innovative aspect of the measure is:

- **New mode of transport exploited** – This has been the first time that the city of Brescia has introduced 18mt CNG buses among their PT fleet. The adoption of these new vehicles (substituting the older ones) cannot be considered actually a "new mode of transport", but an innovative aspect can be found in both the kind of fuel used by the busses and the different transport capacity reached by the 18m busses compared to the 12m ones. It is worth noting that BST has always given a particular attention to users opinions about the service and the environmental issues through periodic customer satisfaction surveys. Then, in case of problems emerging from these surveys, BST has always promptly reacted by adopting a new strategic approach. In this context, besides the environmental issue, also the improvement of the quality of service has been taken into consideration. To this end through the reduction of the bus frequency and, at the same time, the introduction of 18m new Clean buses characterized by a higher capacity BST has found a solution to the problems expressed by citizens in the survey.

### **B2 Research and Technology Development**

BST made a benchmarking research on the market state of art in order to have a deeper knowledge about the following themes:

- the best seat configuration and door layout, in order to guarantee a speed-up of getting on board together with a comfortable travel for all, especially for elderly and disabled people;
- the best integration of the 18mt CNG buses with the urban transport system, both for passengers and for drivers;
- interoperability of AVM<sup>3</sup> hardware with the on demand software.

In order to do that, technical meetings has been organised in Modena to analyze the characteristics of the new Citelis CNG 12 mt bus and in Milan for 8,5mt bus. The choice of which type of bus would have been the optimal solution implied the identification of the required vehicle features. Therefore a market research has been done, focused on the elaboration of the technical specifications to be used to elaborate the tender document. The following aspects have been taken into consideration:

- ✓ rules to eliminate architectural barriers;

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<sup>3</sup> The Automatic Vehicle Monitoring (AVM) is a system that allows to monitor various parameters relating to vehicles in motion including position, stops and a few engine parameters;

- ✓ equipment, design features and rules on “Regional Technical specifications for busses” and “Municipal Technical and Functional Requirements for Buses” for the agreement between Lombardia Region and Brescia Municipality;
- ✓ technical features of European Directive 2001/85/CE and Directive amended on 20 November 2001, in which there are features for means of transportation with more than 9 seats;
- ✓ rules about polluting emissions;
- ✓ CUNA 504-02 standard and European Directive CEE 92/97 on permissible sound levels of motor vehicles.

The selected features are coherent with user needs and the characteristics of the PT services.

### **B3 Situation before CIVITAS**

BST has always cared about environmental and mobility needs. The company has continuously promoted the use of alternative fuels and of clean and energy efficient vehicles, in order to reduce pollution, exhaust gases and noise. Additionally, a particular attention has been given to elderly and disabled people by, for instance, offering a bus service with vehicles equipped with low floor and retractable steps.

Before CIVITAS, BST policy was to replace about 10 buses every year by introducing CNG buses, and experimenting also high-tech solutions. Moreover, in 2003 the company received the award “Environment-Friendly Innovation” for the four innovative hybrid 8 mt long buses (methane-electric).

BST experimented the application of new available technology able to turn an Euro 1 bus into a Euro 4 one. For this project BST received in 2005 another award “Environment-Friendly Innovation” for “Diesel buses turned into full methane buses”. Before the CIVITAS project BST urban fleet had 73/209 CNG vehicles, and the kilometres covered with CNG buses were about 50% out of the total driven by the fleet.

The results of the customer satisfaction (periodically carried out by BST among LPT users) pointed out some overcrowding problems on line 1, for this reason – thanks to CIVITAS – it was decided to substitute all the 12mt long buses running on that line with the new 18m CNG buses (co-funded by Civitas).

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Survey and Definition of methodology and measure concept** (from March 2009 to September 2009) – *The activities were linked to the research made to select the most suitable features to be introduced on line 1.*

**Stage 2: Tender and delivery of the fleet (21 buses)** (from October 2008 to September 2009) – *during this period the first group of CNG 18m busses - 20 units has been purchased (Fig. 2). The acquisition was made through tender procedures scheduling the technical features defined during the research phase (stage 1). From a methodological point of view, all these activities have been formalized in official documents subscribed by the involved partners.*

*In June 2009 a 12m bus (Fig. 3) has been bought in occasion of a meeting attended in Modena as special offer (zero-km vehicle). This bus wasn't characterized by the required technical features, but its purchase fitted with the company strategies and with the high/strategic level objectives of the measure (to increase the use of alternative fuels and to make public transport fleet more efficient and also more comfortable for the elder people, suitable to an on demand transport system).*

*The purchase of 12m busses hasn't been an occasional decision but it was part of the BST strategy (a 12m busses fleet already existed) in coherence with the Municipality and with the Lombardia Region policies that foresee a constant renewal of the fleet.*



Fig. 2 Citelis 18m bus



Fig. 3 Citelis 12m bus

**Stage 3: Buses equipment** (from October 2008 to December 2010) – This stage consisted in the equipment of the purchased busses (Fig. 4) and in their road test (concluded by a test minute). On each new bus the following devices were installed:

- ✓ AVM system (a driver console - Fig. 5 - , a system that allows a radio broadcasting (TETRA), GPS item and GPRS item)
- ✓ Two or three ticketing machines.



Fig. 4 Bus interior equipment

*All the purchased busses were equipped. In particular, the 12 m long bus purchased in occasion of a special offer required a specific equipment (the light itinerary indicator on the front side of the bus required to be adapted to the BST fleet parameters: as a matter of fact, it differed from the other buses as the bus was originally destined to a foreign country). The road tests consisted in road holding, watertight, level of noise and braking/acceleration tests.*

**Stage 4: Training of actors involved** (from January 2009 to December 2010) – Internal technical training activities were attended by about 200 bus driver. The involved driver are the ones able to drive a 18m long vehicle because provided with the specific driving licence. The training consisted in the detailed description of the main new features (technical and mechanical equipment), in a trial lap on the line 1 road map and in the distribution of a brochure containing the information about controls and the technical equipment. This stage was important because no 18m busses had ever been driven before and there were potential problems in some roundabouts and in a dogleg bend near the train station.



Fig. 5 A driver console

**Stage 5: Operational lunch of the measure and system running** (from March 2009 to October 2012) – This stage consisted in putting into service and fitting the new purchased fleet. In particular, the preliminary undertaken actions have been the following:

- ✓ March 2009 Technical timetable review for the line 1 due to the introduction of new longer buses characterized by a lower frequency and by a higher capacity;
- ✓ March 2009 opening of the new CNG bus to the public on line 1 and on the school routes in order to solve the overcrowding problems;
- ✓ July 2009 final authorization by the Municipality to use new CNG buses for public transportation service.

**Stage 6: Tender and delivery of the fleet** (from September 2010 to December 2011<sup>4</sup>) – This stage was referred to the second part of the task 01.06.04 and was dedicated to the purchase of the remaining group of busses through specific tender procedures.

The final set of purchased buses are reported in the following table. All the reported buses have already been put into service and are the ones financially reported in Civitas.

N° of new purchased buses	Type	In service since
20	18m CNG	1st March 2009
1	12m CNG	1st September 2009
2	8m Hybrid	24th February 2011
5	12m CNG	22nd March 2011
2	8m CNG	17th February 2011
2	8m Hybrid (dedicated to the on demand service addressed to disabled people "Accabus", object of the Civitas M06.02)	14th June 2011

From the evaluation process point of view it's important to remark the interest shown by the Municipality during the technical meetings (attended by the Social Policies Councillor) about the new busses to be purchased for the "On demand service" dedicated to disabled/elder people.

Despite the DOW's provision, it's important to stress the following aspects:

- any new 8m CNG buses have been used for the Accabus service (on demand service see measure 06.02 "On demand public transport") because they were not suitable for the disabled transport needs: as a matter of fact, the methane gas tanks didn't allow the wheelchair platform to properly

<sup>4</sup> By the end of the stage, according to the DOW foreseen in December 2011, BST had not purchased the whole planned new busses, because of some difficulties due to PT budget reduction regional laws. This is the reason why BST required to extend the stage.

*move, therefore hybrid 8m buses were used instead of CNG. 8m long buses were already present in the BST fleet (before Civitas). These short vehicles were dedicated to the On demand services called Accabus (for disabled/elder people), to the Bussola service (which links two peripheral parkings) and to the bus service in the smallest downtown roads.*

- *Because of the economical crisis (which led to the reduction of the transport company budget) less buses than the DOW's provision have been bought within Civitas. Therefore, this stage can be considered concluded, but it's important to say that in the last few days of the Civitas BST purchased other 6 new CNG buses (12m long) project. These buses haven't been financially reported in Civitas, therefore they haven't been included in the amount of buses purchased during the project. It's important to credit the commitment of BST for pursuing the fleet renewal, notwithstanding the economic crisis.*



Fig. 6 - 8,5m busses

## B5 Inter-relationships with other measures

The measure has potential interactions with M.06.02 “On demand public transport service in Brescia”, in particular because both of the measures belong to the same BST policy aiming “to improve the public transport service quality with less pollutant and more comfortable vehicles”, and for this reason 3 of the 8mt busses purchased within this measure have then been used for the on demand services.

## C. Evaluation – methodology and results

From the evaluation point of view it's important to remind that the main objective of the measure consists on the one hand in renewing the fleet to reduce pollutant emissions (incrementing progressively the number of methane gas powered buses), on the other in keeping high the transport service quality level, especially for the most loaded bus lines (such as line 1 which crosses the city from North to South). As a matter of fact, line 1 is characterized by overcrowding problems and it suffered also punctuality problems. This is the reason why specific indicators were chosen to monitor the whole fleet, while others were related to line 1 only (see the list of indicators reported below).

### C1 Measurement methodology

The indicators have been divided into two macro-categories: main indicators and complementary indicators.

“Main” indicators are able to evaluate the measure efficiency in terms of objectives achievement. In addition “complementary” indicators were introduced in order to asses specific issues and to better understand the measure performance.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1.	Operating revenues	Average Operating revenues	Total income generated from fares and tickets divided by total passengers. Indicator directly provided by Brescia Trasporti	Main Indicator; First data collection after the OP: year 2009
2.	Operating costs	Average operating cost	Total operating cost (raw, service and personnel) divided by total passengers. Indicator directly provided by Brescia Trasporti	Main Indicator; First data collection after the OP: year 2009
3.	Fuel consumption	Vehicle efficiency fuel	Tot fuel consumed per year and by type of vehicles (lt diesel; m <sup>3</sup> cng); Tot km travelled by fleet per year; Fleet composition (BST database)	Main Indicator; First data collection after the OP: year 2009
4.	Emissions	CO emissions	Number of vehicles, Km travelled by fleet per year and CO emissions per year	Related to all fleet; complementary Indicator;

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No.	Impact	Indicator	Data used	Comments
			(kg). (BST database)	First data collection after the OP: year 2009
5.	Emissions	NOx emissions	Number of vehicles, Km travelled by fleet per year and NOx emissions per year (kg). (BST database)	Related to all fleet; complementary Indicator; First data collection after the OP: year 2009
6.	Emissions	Small particulate emissions	Number of vehicles, Km travelled by fleet per year and SP emissions per year (kg). (BST database)	Related to all fleet; complementary Indicator; First data collection after the OP: year 2009
7.	Emissions	% Km clean bus	Km travelled by each kind of busses (BST database)	Main Indicator; First data collection after the OP: year 2009
8.	Emissions	NCG busses/total fleet	Fleet composition by type of fuel (BST database)	Main Indicator; First data collection after the OP: year 2009
9.	Noise	Noise perception	Measurement of noise perception for a bus driver at work.	Complementary Indicator; First data collection after the OP: year 2009
10.	Service reliability	Accuracy of time keeping	Data come from the tele-data collectors situated in the town centre. (BST database)	Main Indicator Referred only to Line 1; First data collection after the OP: year 2009
11.	Vehicle occupancy	Average occupancy	Number of passengers of the line1 recorded by the validation machines located	Main Indicator Referred only to Line 1;

No.	Impact	Indicator	Data used	Comments
			on board. Number of trips covered by line1 busses	First data collection after the OP: year 2009
12.	PT quality increase	Environmental care	Customer Satisfaction questionnaires results	Complementary Indicator First data collection after the OP: May 2009
13.	Fuel consumption	Average fleet age	Average age of the fleet	Complementary Indicator; First data collection after the OP: year 2009

Detailed description of the indicator methodologies:

- **Indicator 1 (AVERAGE OPERATING REVENUES)** – Ratio of total income generated from fares and tickets divided by the total passengers.
- **Indicator 2 (AVERAGE OPERATING COST)** – Ratio of total operating costs incurred by the fleet (or line1) divided by the total passengers.
- **Indicator 3 (VEHICLE FUEL EFFICIENCY)** – Vehicle fuel efficiency for each type of vehicle composing the fleet measured in MJ/v\*vkm. In particular, the fleet composition is referred to the fleet which is active at the end of each year, considering the dismissing of the older vehicles.
- **Indicator 4 (CO EMISSIONS)** – The calculation of the CO emission has been performed using an internal model (similar to COPERT) based on fuel consumption by each vehicle composing the fleet from Jan to Dec 2008 and on the emission factors for the specific pollutant agent. In particular, the fleet composition is referred to the fleet which is active at the end of each year, considering the disuse of the older vehicles.
- **Indicator 5 (NO<sub>x</sub> EMISSIONS)** –The description of this indicator is similar to the description reported above (see Indicator 4).
- **Indicator 6 (SMALL PARTICULATE EMISSIONS)** – The description of this indicator is similar to the description reported above (see Indicator 4).
- **Indicator 7 (% KM CLEAN BUS)** – It's the percentage between the cover clean km and the total km.
- **Indicator 8 (N. CLEAN BUSES)** – Number of NCG busses/number of complete fleet
- **Indicator 9 (NOISE PERCEPTION)** – Measurement of noise perception for a bus driver at work

- **Indicator 10** (ACCURACY OF TIME KEEPING) – Number of percentage of PT on line1 that arrive within an acceptable interval (3min) around the planned times given by timetable.
- **Indicator 11** (AVERAGE OCCUPANCY) – Passengers per trip of Line 1. Number of passengers recorded + 60min ticket recorded per trip in the given period (3monthly).
- **Indicator 12** (ENVIRONMENTAL CARE) – The data is collected in Customer Satisfaction questionnaires each 4 months with interviews to the users. The related question is: "Brescia Trasporti takes care for the pollution's reduction."
- **Indicator 13** (AVERAGE FLEET AGE) –This indicator is linked to the indicator n. 3 "Vehicle fuel efficiency", as younger busses have new technologies that save fuel.

It's important to stress that indicators 1 (Average Operating revenues), 2 (Average operating cost), 3 (Vehicle fuel efficiency), 4 (CO emissions), 5 (Emissions), 6 (Small particulate emissions), 7 (% Km clean bus), 8 (NCG busses/total fleet), 9 (Noise emission), 12 (Environmental care) e 13 (Average fleet age) - which are related to the calculation of the operative costs/revenues, the fuel efficiency, the pollutant emissions, the km travelled by clean vehicles, the number of methane gas powered vehicles, the levels of noise perception, the environmental care and the average age- are referred to the whole fleet (in particular to the fleet which is active at the end of each year, considering the disuse of the older vehicles); indicators 10 and 11 - which express the service punctuality and the overcrowding on board - are referred to the line1, which was set as "demo area" of the measure.

## C1.2 Establishing a Baseline

The Municipality of Brescia is historically characterized by a unitary public transport service management. The local public transport system in Brescia, since the beginning of the Sixties, has been based exclusively on busses (previously there were also tram and trolley busses). Since 2001 LPT has been managed by Brescia Trasporti SpA (BST), after the asset-stripping experienced by ASM Brescia SpA.

Brescia Trasporti is part of Brescia Mobilità SpA (Metropolitan Mobility Company), which deals with people/freight mobility processes and traffic management.

Since July 2004 transport Company has managed TPL service both in Brescia and in the 14 neighbour Municipalities.

Recently the recurrent substitution of the older busses has been made introducing methane gas powered vehicles instead of the diesel ones. Methane gas powered vehicles can be refuelled directly at the bus depot, where there's a methane gas compressing/filling station (one of the few examples in Italy), owned by the company itself.

Methane gas powered busses, which are newer and less polluting, cover the major part of the service, while the oldest vehicles are used mainly during peak hours.

As the operative phase of the measure was set on March 2009 (when the new busses were put into operation), year 2008 has been chosen as Baseline. In 2008 the fleet was composed by 110 diesel powered busses and by 89 methane gas powered (total number of vehicles: 119). It's important to specify that before 2008 no 18mt bus had ever been purchased. As a matter of fact, vehicles were 95% 12 m long and 5% 8 m long. Minibuses are used for the On demand service "Accabus", for the "Bussola" (which links two peripheral parking) and for the bus service in the smallest downtown roads.

The original main goal of the Measure was the purchase of 40 new methane gas powered busses. The first 20 18 m busses substituted in full the busses running on Line1, which is one of the most important (and loaded) bus line in Brescia and which strongly structure the mobility network of the city. This is the reason why specific indicators were chosen to monitor the whole fleet, while others were related to line 1 only.

The following tables show the baseline situation of the indicators according to the two categories mentioned above: indicators referred to the whole fleet (Table 1) and indicators referred to Line1 only (Table 2).

Indicators related to the whole fleet	BASELINE (2008)
1) average operating revenues	A = 0,269 €/passengers
2) average operating costs	A = 0,585 €/passengers
3) fuel efficiency of the fleet (MJ/v*vkm)	0,4628
4) CO emissions (g/ v*vkm)	0,4138
5) NOX emissions (g/ v*vkm)	1,2639
6) Small particulate emissions(g/ v*vkm)	0,0147
7) % Km clean bus	54,86 % of kms travelled by clean busses/total kms
8) NCG busses/total fleet	45% of clean busses / total busses;
9) Noise perception	Average noise level: 72,8 db(A)
12) Environmental care	Result of customer satisfaction 2008/I: 6,79/10 Result of customer satisfaction 2008/II: 7,08/10 Result of customer satisfaction 2008/III: 7,19/10
13) Average fleet age	9 years

**Table 1 – Baseline for the indicators related to the whole fleet**

Indicators related to the Line 1	BASELINE (2008)
10) Accuracy of time keeping	89,9% of trips
11) Average occupancy	86,89 passengers/trip

**Table 2 - Baseline for the indicators related to Line 1.**

### C1.3 Building the Business-as-Usual

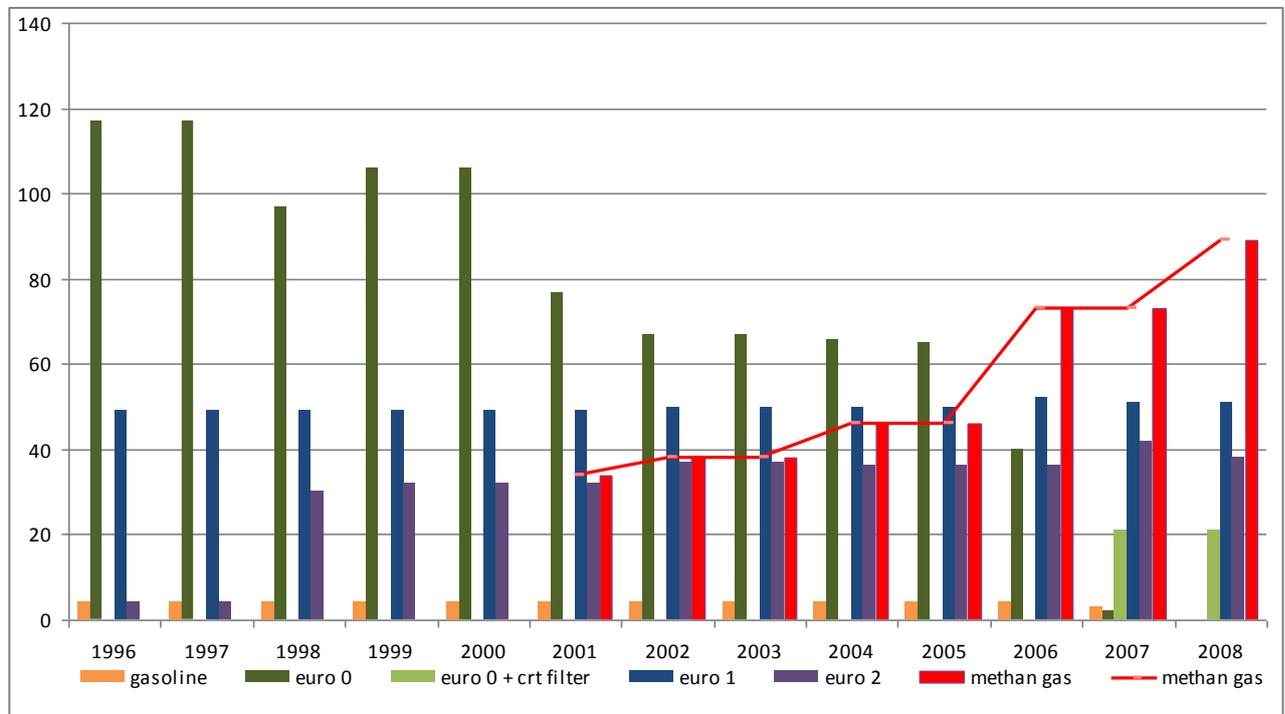
BaU scenario is built following mainly two approaches: when consolidated historical data series were available, the projection of the trend curve has been made; otherwise assumptions have been taken basing on both the technical manager declarations and the fleet composition trend. It's important to highlight that the methodological assumptions, on which the BaU scenario has been built, take inspiration from the historical policies adopted by the transport company, as they are able to clarify the BaU context without the Civitas initiative. Therefore, the “transport” approach has been as much as possible simplified.

The BaU construction has been based on the following two aspects:

- the consolidated Brescia Trasporti policy to renew the fleet introducing CNG busses (since the end of the Nineties);
- an in depth examination of the Line1, which is one of the most important bus lines in Brescia.

In this direction, it's very important to underline that both aspects can be considered as complementary one to the other (and not alternative): on the one hand, emphasis is given to the measure impacts in the overall fleet renewal - through the monitoring of indicators n.1 (Average Operating revenues), n.2 (Average operating cost), n.3 (Vehicle fuel efficiency), n.4 (CO emissions), n.5 (Emissions), n.6 (Small particulate emissions), n.7 (% Km clean bus), 8 (NCG busses/total fleet), n. 9 (Noise emission), n.12 (Environmental care) e n.13 (Average fleet age) ; on the other hand, the focus on Line1 - through the calculation of indicators n.10 "Accuracy of time keeping" and n.11 "Average occupancy" - can provide precious information to better understand the local context, with a view to the measure up-scaling (for more details see the section C4).

The first aspect is well synthesized by the fleet renewal historical trend, which surely modifies the relative pollutant emissions (see the following Graph 1).



**Graph 1 Brescia Trasporti fleet renewal historical trend**

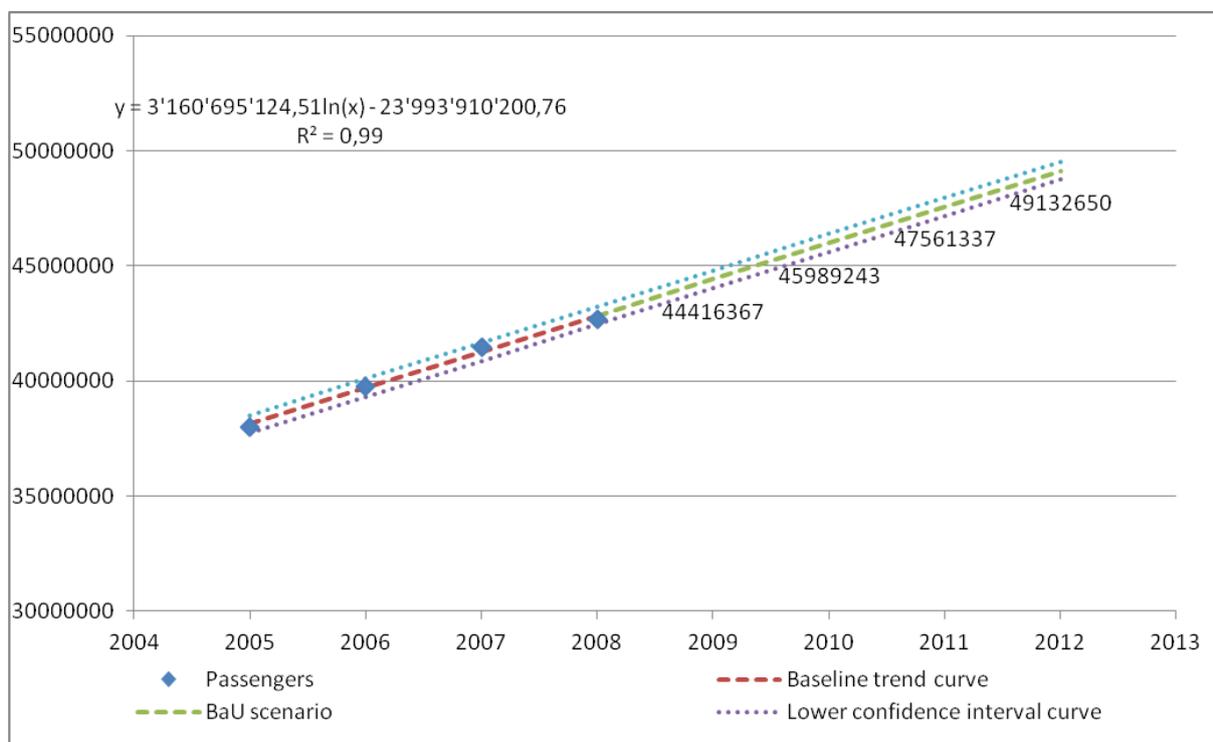
The second aspect is particularly interesting for the evaluation of the measure effectiveness, in relation to the metro start up in 2013, when, thanks to the CIVITAS funding, all the diesel busses will be disused and the fleet will be entirely composed by CNG methane powered busses (including 2 new generation 8mt busses ).

It's important to underline that in the BaU social and economic conditions have been taken into consideration.

As regards **the economic indicators n.1 "Average Operating revenues" and n.2 "Average operating cost"**, the historical series of the indicator is not available, therefore the following considerations have been made: in terms of total operating revenues the BaU scenario in 2012 can be considered similar to

the Baseline situation (2008), while as regards the total operating costs, it's possible to assume an yearly increase by 1% (due to an average increase of the fuel cost, keeping constant the mileage of the fleet). Analysing the historical fleet renewal trend (Graph 3), new busses are usually purchased every 2-3 years. In 2008 Brescia Trasporti purchased new busses, therefore costs and revenues in 2012 can equal those in 2008.

In 2012 the total number of passengers could have been different from those in 2008, therefore the data projection, using the historical data series up to 2008, provided the estimation of the bus network passengers in 2012. The obtained BaU values for the total number of passenger year 2012 are reported in Graph 2.



**Graph 2 BaU scenario of the total number of bus network passengers a year, basing on the historical data series**

Indicators related to the whole fleet	BaU (2012)
1) average operating revenues	0,234 €/passenger
2) average operating costs	0,524 €/passenger

**Table 3 - BaU for the indicators related to the whole fleet**

As regard **indicators n.3** (Vehicle fuel efficiency), **n.4** (CO emissions), **n.5** (Emissions), **n.6** (Small particulate emissions), **n.7** (% Km clean bus), historical series were not available, therefore the following considerations have been made:

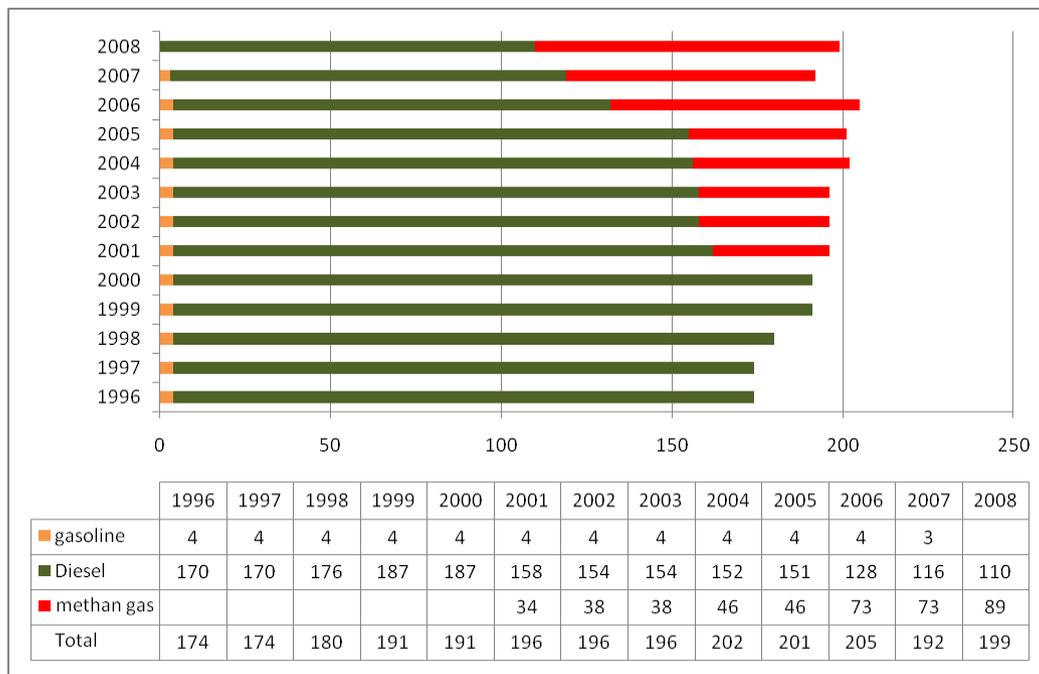
- the bus urban network was substantially modified in 2004, when it was extended to the suburban area of Brescia. Therefore, since 2004 the total number of km travelled by the whole fleet can be considered constant, because the fleet itineraries, frequency or capacity didn't vary considerably;
- the km covered by each kind of vehicle has been set constant;
- the fleet composition has been estimated in 2012, keeping the same kind of vehicles of the baseline situation but varying the number of vehicles.

As a consequence of the methodological assumptions mentioned above, in the BaU scenario, the energy and the fuel consumption are constant respect to the baseline situation, while the emissions slightly increase.

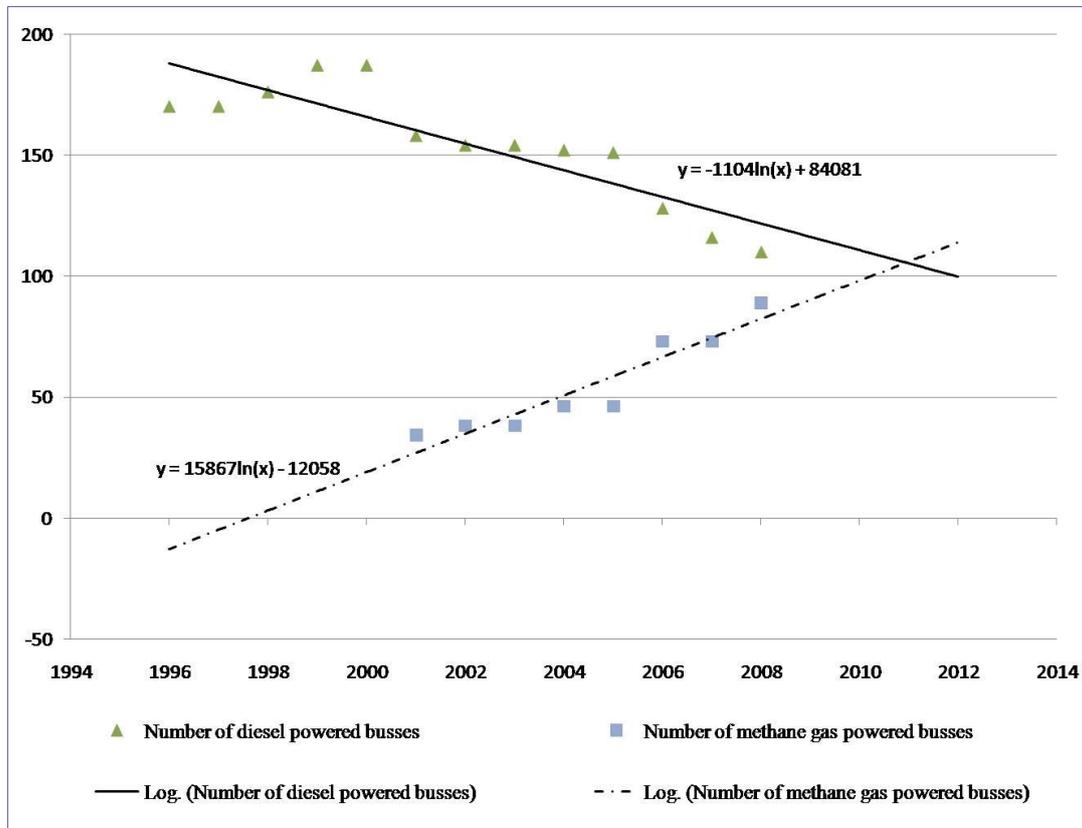
Indicators related to the whole fleet	BaU (2012)
3) fuel efficiency of the fleet (MJ/ v*vkm)	0,535
4) CO emissions (g/ v*vkm)	0,4635
5) NOX emissions (g/ v*vkm)	1,6121
6) Small particulate emissions(g/ v*vkm)	0,0156
7) % Km clean bus	54,86 % of kms travelled by clean busses/total kms

**Table 4 - BaU for the indicators related to the whole fleet**

Aiming at estimating the **indicator n.8** (NCG busses/total fleet), the only variable parameter is the number of busses composing the fleet. The estimation of the fleet in 2012 has been done projecting the historical trends (Graph. 3) for each kind of bus.



**Graph 3 Evolution of the Brescia Trasporti bus fleet composition (historical data series)**



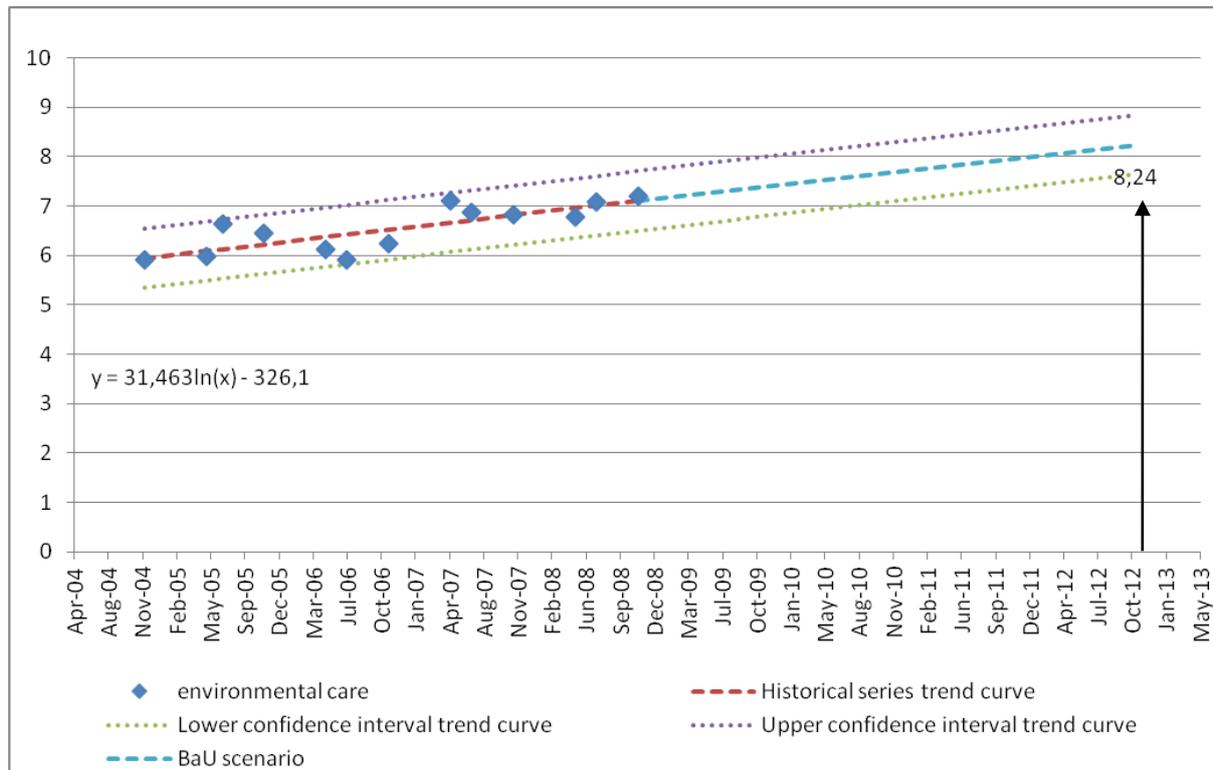
**Graph 4 Evolution of the Brescia Trasporti bus fleet composition**

The BaU scenario for the **indicator 9 (Noise perceived by driver)** equals the Baseline value, because the estimated fleet renewal doesn't significantly influence the average noise produced by the fleet.

Indicators related to the whole fleet	BaU (2012)
8) NCG busses/total fleet	53% of clean busses / total busses
9) Noise perception	72,8 db

**Table 5 - BaU for the indicators related to the whole fleet**

As regards the environmental care, the historical series of the results obtained for the customer satisfaction survey are available, therefore, in order to calculate the BaU scenario of the indicator n.12 in 2012, it's possible to project the historical trend (see Graph 4).



**Graph 5 – BaU scenario for the indicator 12 “Environmental care”, expressed as judgement on a 0 to 10 scale. It derives from the customer satisfaction survey results.**

As regard the average fleet age (indicator 13), the following considerations have been made: the BST historical policy is to keep the fleet younger than 10 years. The purchase of new vehicles for the fleet renewal are made in alternate years and depending on the availability of financial contributions (such as for example the Lombardia Regional funding). BaU scenario in 2012 can be set on 9,5 years. This value takes into consideration the following events:

- since July 2004 also the suburban area has been served by the bus network;
- in 2008 (baseline year) new vehicles have been purchased, therefore, the average age is lower than usual and is 9 years.
- 

Indicators related to the whole fleet	BaU (2012)
12) Environmental care	8,24/10 (Nov 2012)
13) Average fleet age	9,5 years

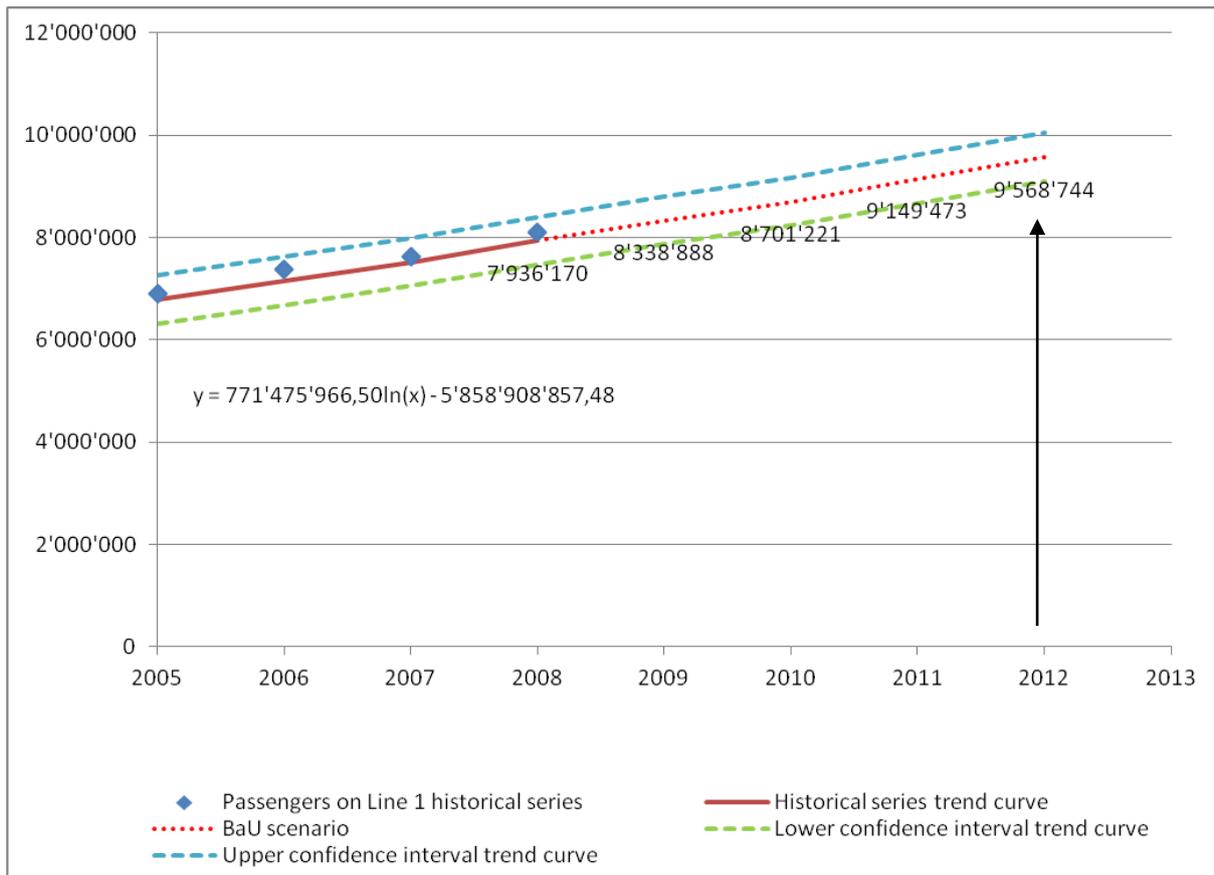
**Table 6 – BaU scenario for the indicators related to the whole fleet**

Indicator n.10 (accuracy of time keeping), referred to Line 1, evaluates the busses punctuality during their passages in the city centre. As it’s not possible to estimate the BaU scenario in 2012 basing on historical data series, the following assumption has been taken: bus punctuality mainly depends on function of the bus frequency and capacity (excluding the traffic congestion which can be considered a non-governable external factor). As it has been assumed that without CIVITAS itineraries, frequencies

and capacities wouldn't have changed compared to the baseline situation, it's possible to say that indicator n.10 in 2012 can equal or be, at worst, lower than the baseline value.

In this specific case, the value equals the baseline one, because Line 1 runs on a dedicated lane, therefore it's less conditioned by delays due to external factors than other lines.

As regard indicator n.11 (average occupancy), the BaU scenario can be estimated basing on the line 1 passenger historical trend projection (Graph 5) and assuming the same number of rides registered in the Baseline year.



**Graph 6 BaU scenario of the number of Line 1 passengers**

Indicators related to the Line 1	BaU (2012)
10) accuracy of time keeping	89,9 %
11) average occupancy	102,56 passengers/ride

**Table 7 – BaU scenario for the indicators related to the bus Line 1**

## C2 Measure results

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

### C2.1 Economy

**Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”**

Indicator	Before (year 2008)	After (years 2009- 2011)	BaU (years 2009- 2011)	Difference: After –Before	Difference: After – B-a-U
1) average operating revenues	A= 0,269 €/passenger	<b>year 2009:</b> A= 0,259 €/passenger	<b>year 2009:</b> A= 0,259 €/passenger	- 0,01 €/passenger	0 €/passenger
		<b>year 2010:</b> A= 0,257 €/passengers	<b>year 2010:</b> A= 0,250 €/passenger	- 0,012 €/passenger	+ 0,007 €/passenger
		<b>year 2011:</b> A= 0,281 €/passengers	<b>year 2011:</b> A=0,241 €/passenger	+ 0,012 €/passenger	+ 0,04 €/passenger
2) average operating costs	A = 0,585 €/passenger	<b>year 2009:</b> A = 0,572 €/passenger	<b>year 2009:</b> A= 0,562 €/passenger	+ 0,013 €/passenger	+ 0,01 €/passenger
		<b>year 2010:</b> A = 0,574 €/passenger	<b>year 2010:</b> A= 0,548 €/passenger	- 0,011 €/passenger	+ 0,026 €/passenger
		<b>year 2011:</b> A = 0,613 €/passenger	<b>year 2011:</b> A= 0,536 €/passenger	+ 0,028 €/passenger	+ 0,077 €/passenger

The average operating revenues (indicator 1) increased from year 2008 to year 2011.

In 2011 (42.006.599 passengers) an overall decrease of LPT passengers is observed respect to the ex ante situation (in 2008 there were 42.692.823 passengers).

The operating revenues are calculated in relation to bus fares (occasional + systematic users)

In 2009-2010 there was a slight decrease of the occasional users. In 2011 the ticket fare increate from 1,00€ to 1,20€) with a general decreasing of the number of passengers (about -1.3%, in the year 2010/2011)

On the contrary, at the same time, passengers transported on Line 1 register an increasing trend, even if on this Line the frequency of the busses was reduced thanks to the introduction (within this Civitas measure) of vehicles with higher capacity (18mt long buses).

It important to highlight that in 2011 higher fuel costs of diesel and of methane significantly influenced the operative costs, that were also influenced by higher costs in general maintenance of the vehicles.

## C2.2 Energy

**Table C2.2.1: Measure results for the indicators of the category “Energy”**

Indicator	Before (year 2008)	After (years 2009- 2012)	BaU	Difference: After –Before	Difference: After – B-a-U
3) fuel efficiency of the fleet (MJ/v*vkm)	0,4628	<b>year 2009:</b> 0,8215	<b>year 2009:</b> 0,43	+ 0,3587	+ 0,3915
		<b>year 2010:</b> 0,8536	<b>year 2010:</b> 0,45	+ 0,3908	+ 0,4036
		<b>year 2011:</b> 1,038	<b>year 2011:</b> 0,49	+ 0,5752	+ 0,548
13) Average fleet age	9 years	<b>year 2009:</b> 8,4 years	<b>year 2009:</b> 9,5 years	- 0,6	- 1,1
		<b>year 2010:</b> 9,3 years	<b>year 2010:</b> 9,5 years	+ 0,3	- 0,2
		<b>year 2011:</b> 9,9 years	<b>year 2011:</b> 9,5 years	+ 0,9	+ 0,4

Comments concerning indicators n. 3 and 13 are reported under the following “C.2.3 Environment” subheading.

## C2.3 Environment

**Table C2.3.1: Measure results for the indicators of the category “Environment”**

Indicators	Before (year 2008)	After (years 2009/2012)	BaU	Difference: After –Before	Difference: After – B-a-U
4) CO emissions (g/v*vkm)	0,4138	<b>year 2009:</b> 0,6678	<b>year 2009:</b> 0,3885	+ 0,254	+ 0,279
		<b>year 2010:</b> 0,7011	<b>year 2010:</b> 0,4033	+ 0,2873	+ 0,2978
		<b>year 2011:</b> 0,8817	<b>year 2011:</b> 0,4296	+ 0,468	+ 0,452
5) NO <sub>x</sub> emissions (g/v*vkm )	1,2639	<b>year 2009:</b> 2,069	<b>year 2009:</b> 1,1688	+ 0,8051	+ 0,900
		<b>year 2010:</b> 2,1284	<b>year 2010:</b> 1,2537	+ 0,8645	+ 0,8747
		<b>year 2011:</b> 2,4548	<b>year 2011:</b> 1,4065	+ 1,1909	+ 1,0483

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **01.06**

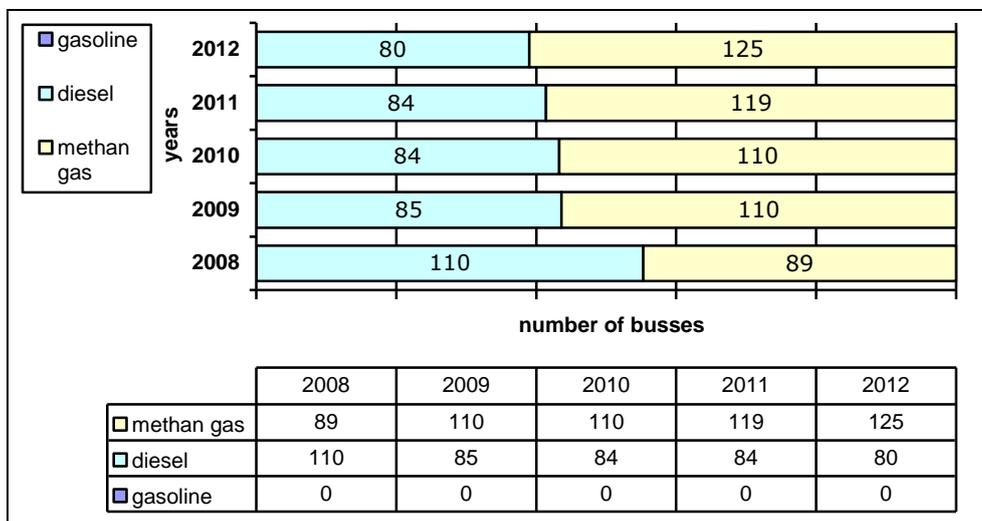
Indicators	Before (year 2008)	After (years 2009/2012)	BaU	Difference: After –Before	Difference: After – B-a-U
6) Small particulate emissions (g/ v*vkm)	0,0147	<b>year 2009:</b> 0,0356	<b>year 2009:</b> 0,0139	+ 0,0209	+ 0,0217
		<b>year 2010:</b> 0,0383	<b>year 2010:</b> 0,0144	+ 0,0236	+ 0,0239
		<b>year 2011:</b> 0,0485	<b>year 2011:</b> 0,0151	+ 0,0338	+ 0,0334
7) % Km clean bus (% of km travelled by clean busses/total km)	54,86 %	<b>year 2009:</b> 67,31 %	<b>years 2009:</b> 54,86 %	+ 12,45	+ 12,45
		<b>year 2010:</b> 70,73 %	<b>year 2010:</b> 54,86 %	+ 15,87	+ 15,87
		<b>year 2011:</b> 73,37%	<b>year 2011:</b> 54,86 %	+ 18,51	+ 18,51
8) NCG busses/total fleet (% of clean busses / total busses)	45%	<b>year 2009:</b> 56%	<b>year 2009:</b> 44%	+ 11%	+ 12 %
		<b>year 2010:</b> 57%	<b>year 2010:</b> 47%	+ 12%	+ % 10
		<b>year 2011:</b> 59%	<b>year 2011:</b> 50%	+ 14%	+ 9%
9) Noise perception	Average sound level: 72,8 db(A)	<b>year 2009:</b> Average sound level: 72,5 db(A) – (referred to 18 mts busses).	<b>year 2009:</b> 72,8 db(A)	- 0,3	- 0,3
		<b>year 2010:</b> Average sound level: 72,5 db(A) – (referred to 18 m busses)	<b>year 2010:</b> 72,8 db(A)	- 0,3	- 0,3
		<b>year 2011:</b> Not Assessable	<b>year 2011:</b> 72,8 db(A)	Not Assessable	Not Assessable

Indicators concerning the LPT fleet fuel efficiency (indicator n. 3 expressed in MJ/v\*vkm) and the pollutant gas emissions (indicators n. 4, 5 and 6 expressed in g/v\*vkm) are calculated basing on the mileage run by each kind of bus, in relation to its fuel type.

In particular, observing their trend, an overall increase of the emissions was registered, mainly because of the increasing age of the fleet (indicator 13), that, notwithstanding the Civitas contribution to the methane gas powered fleet renewal remains higher than 9 years..

The after data collection goes up to 2011 because was made on annual basis: therefore the renewal of the fleet which took place in 2012 (see the following graph) was taken into consideration. According to the provisional information provided by the Transport Company, the purchase of new vehicles and the dismissing of old vehicles foreseen in 2012 should contribute in improving the average fleet age.

In particular, BST (out of Civitas contribution) in 2012 has already purchased 6 new CNG buses (12 m long buses).



**Graph 7 Brescia Trasporti fleet renewal from 2008 to 2012**

Regarding the whole fleet fuel consumption and gas emissions registered an overall worsening (in the fleet there are still EURO 1 buses that for eg. produced 2.0032gCO/v\*vkm in 2010; the same consideration can be done also concerning other pollutants).

Notwithstanding Brescia Trasporti effort in progressively introducing a clean fleet from the data is evident that many diesel buses are still circulating.

A general consideration should be done if we compare an “EURO 0+crt filter” bus with a CNG bus:

- NOx emission produced by “EURO 0+crt filter” is about 120 times higher than CNG
- Small particulate produced by “EURO 0+crt filter” is about 23 times higher than CNG

Only the CNG component of the fleet (which has been the actual object of the Civitas contribution), had an opposite trend: fuel consumption and the emissions decreased, notwithstanding the significant increase of the methane gas powered busses mileage (indicator n.7).

BUS METHANE GAS	2008	2009	2010	2011
<b>Km travelled per year</b>	4.658.436	5.558.100	5.845.398	5.946.317
<b>CO emissions (g/ v*vkm)</b>	0,1854	0,1500	0,1500	0,1387
<b>NOx emissions (g/ v*vkm)</b>	0,0279	0,0225	0,0225	0,0208
<b>Small particulate emissions (g/ v*vkm)</b>	0,0002	0,0002	0,0002	0,0002

**Table 8 Pollutant gas emissions produced by the methane gas vehicles composing the Brescia Trasporti fleet**

Without the Civitas contribution, considering the recent reduction to the LPT funding for the fleet renewal, the situation would have been even worse, because many new busses wouldn't have been purchased, limiting the actions for the emissions reduction, to the crt filters installation on the oldest vehicles.

This consideration (which is not easily quantifiable) wasn't taken into account in the BaU scenario, which was built basing only on the projection of the historical fleet composition by type of fuel. This is the reason why the BaU scenario can be considered slightly better than the actual ones.

Analyzing the results obtained for indicator n. 8 (% of clean busses/total busses), alongside the achievement of the goal of increasing the methane gas powered vehicles, it's possible to recognize the transport company policy to speed up as much as possible the purchase of the new vehicles (the number of CNG busses respect to the whole fleet increased by 11% already in 2009) and the implementation of the 18m busses for the renewal of the whole Line 1.

## C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category "Transport"**

Indicator	Before (year 2008)	After (years 2009/2010)	BaU (2008-2012)	Difference: After – Before	Difference: After – B-a-U
10) accuracy of time keeping (% of trips)	average value: 89,9%	<b>year 2009:</b> average value: 86,3% of trips	<b>years 2009:</b> average value: 89,9 % of trips	- 3,6	- 3,6
		<b>year 2010:</b> average value: 90,0% of trips	<b>years 2010:</b> average value: 89,9 % of trips	+ 0,1	+ 0,1
		<b>year 2011:</b> average value: 90,6% of trips	<b>years 2011:</b> average value: 89,9 % of trips	+ 0,7	+ 0,7
11) average occupancy (passengers/ride)	86,89	<b>year 2009:</b> 101,74	<b>year 2009:</b> 89,37	+ 14,85	+ 12,37
		<b>year 2010:</b> 110,86	<b>year 2010:</b> 93,25	+ 23,97	+ 17,61
		<b>year 2011:</b> 110,38	<b>year 2011:</b> 98,06	+ 23,49	+ 7,82

As regard indicator n.10 (accuracy of time keeping), referred to the line 1, it's interesting to remark the following phenomenon: considering the monthly average values referred to two monitoring bus stations (next to the General Hospital and to the Train Station), a higher time accuracy is observed at the Hospital station (near to the terminus, from which line 1 departs), while a lower time accuracy is observed at the Train station (often 10% lower). This delay can be observed especially at the beginning of the project, when the new 18m vehicles were introduced, probably because of the difficulties in the manoeuvres on road.

Other reasons linked to the delay along the lines could be the following:

- the presence of lanes dedicated to the bus circulation is scarce, therefore busses suffer from the traffic congestion or drawbacks;
- presence of moving road works for the metro line station building (just along the line 1 layout) which caused many line deviations or wastes of time especially in 2009 and 2010;
- being the most important bus line, each bus station along the Line 1 is used by the users, causing more time for the passengers' transport through the use of 18m vehicles.

Indicator n. 11 (average occupancy) is function of the bus frequency and capacity. The introduction of 18m busses brought to a higher number of available seats respect to the previous kind of busses which were 12m long.

Kind of bus (length)	Seating capacity	Standing room	Total
18 m	32	124	156
12 m	24	67	91

**Table 9 Technical features characterizing some kind of buses composing the Brescia Trasporti fleet**

The higher seating capacity on the 18m long vehicles allows to reduce the overcrowding problems increasing the number of passengers per ride (since 2009).

Even if the bus frequency is reduced, new buses offer a more comfortable service to the users (improved seating, air-conditioning, less vibration).

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category "Society"**

Indicator	Before (year 2008)	After (years 2009/2010)	BaU (2009/2010)	Difference: After – Before	Difference: After – B-a-U
12) environmental care (Results of the customer satisfaction)	2008/I: 6,79/10 2008/II: 7,08/10 2008/III: 7,19/10	<b>year 2009:</b>	<b>year 2009:</b>		
		2009/I: 7,04/10	2009/I: 7,25/10	+ 0,25/10	- 0,17/10
		2009/II: 7,33/10	2009/II: 7,30/10	+ 0,25/10	+ 0,03/10
		2009/III: 7,04/10	2009/III: 7,39/10	-0,15/10	- 0,35/10
		<b>year 2010:</b>	<b>year 2010:</b>		
		2010/I: 7,33/10	2010/I: 7,54/10	+ 0,25/10	- 0,21/10
		2010/II: 7,27/10	2010/II: 7,58/10	+ 0,19/10	- 0,31/10
		2010/III: 7,19 /10	2010/III: 7,68/10	0/10	- 0,49/10
		<b>year 2011:</b>	<b>year 2011:</b>		
2011/I: 7,54/10	2011/I: 7,82/10	+ 0,75/10	+ 0,26/10		
2011/II: 7,27/10	2011/II: 7,87/10	+ 0,19/10	- 0,60/10		
2011/III:7,10 /10	2011/III:7,96/10	- 0,09/10	- 0,86/10		

Users' judgement about the BST care for environment is generally positive and this is confirmed by a slight substantial increase of the values of the indicator n.12.

## Summary of the main CBA results (ref. Annex 3)

The CBA was out on comparing the scenario 0 (Reference case or BaU), which keeps unchanged the fleet operating in 2008 and foresees the gradual substitution of the older buses with 12 m CNG ones, and scenario 1 (Civitas measure), which foresees the purchase and the activation, on line 1 of new CNG 18m long buses.

The purchase of buses described in the Civitas scenario (Scenario 1) is re-paid in approx. 4 years (NPV>0 at 2012), due to fact that Line 1 offers a better transport service. The new buses on that line have lower maintenance costs and produce lower emissions in comparison to scenario 0.

For more details about the CBA methodological assumptions and calculation see Annex 3.

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>To increase the weight of the CNG fleet (40 new CNG buses – that is up to 25% of the whole fleet and 3 CNG buses for On demand transport service) in order to reduce emission of Public Transport.</p> <p><i>This objective can be considered achieved in full. The indicators able to express this achievement are the following:</i></p> <p><i>ind. 8 (CNG busses/total fleet)</i>  <i>Before (year 2008) = 45%</i>  <i>After (year 2011) = 59%</i></p> <p><i>ind. 7 (% kms travelled by clean buses respect to the total amount of kms travelled by the fleet)</i>  <i>Before (year 2008) = 54,86 %</i>  <i>After (year 2011) = 73,37 %</i></p> <p><i>Specific indicators referred to the emissions are:</i></p> <p><i>ind. 4 (CO emissions – g/v*vkm)</i>  <i>Before (year 2008) = 0,4138</i>  <i>After (year 2011) = 0,8817</i></p> <p><i>ind. 5 (NOx emissions g/ v*vkm )</i>  <i>Before (year 2008) = 1,2639</i>  <i>After (year 2011) = 2,4548</i></p> <p><i>ind. 6 (Small Particulate emissions – g/ v*vkm)</i>  <i>Before (year 2008) = 0,0147</i>  <i>After (year 2011) = 0,0485</i></p> <p><i>As explained in the comments to the “C.2.3 Environment” subheading, even if the fuel consumption and the gas emissions registered an overall worsening, if the only CNG component of the fleet is considered (which has been the actual object of the Civitas contribution), then the observed trend is opposite: the fuel consumption and the emissions decreased</i></p>	★★
2	To keep the fleet younger than 8 years;	N.A.

Measure title: **CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **01.06**

No.	Target	Rating
	<p><i>The achievement of this objective is expressed by the following indicator:</i></p> <p><i>ind. 13 Average fleet age</i>  <i>Before (year 2008) = 9 years</i>  <i>After (year 2011) = 9,9 years</i></p> <p><i>According to the provisional information provided by the Transport Company, the purchase of new vehicles and the dismissal of old vehicles foreseen in 2012 should contribute in improving the average fleet age. In particular, BST (out of Civitas contribution) in 2012 has already purchased 6 new methane gas powered 12 m long buses and likely will purchase 3 new diesel powered busses and dispose 5 diesel powered old busses.</i></p>	
3	<p>To acquire CNG 18 metres busses in order to minimize overcrowding on the busses (because of the increase of passengers);</p> <p><i>This objective is measured referring to the Line 1 of the bus network, as the 18m long busses run on that line. The goal can be considered achieved in full because introducing longer vehicles, the busses capacity increased. Therefore, the average occupancy increased without worsening the bus overcrowding. The indicator able to express the objective achievement is the following:</i></p> <p><i>ind. 11 (average occupancy – related to the line 1 where the 18m long busses have been introduced)</i></p> <p><i>Before (year 2008) = 86,89 passengers/ride</i>  <i>After (year 2011) = 110,38 passengers/ride</i></p>	**
4	<p>To improve accuracy of time reducing passages of the busses and to decrease the passage of the busses in the old town reducing trips and increasing seats</p> <p><i>This objective is measured referring to the Line 1 of the bus network, as the 18m long busses will run on that line. The goal can be considered achieved in full because introducing longer vehicles, the bus frequency has been reduced, therefore also the passages in the city centre.</i></p> <p><i>ind. 10 (accuracy of time keeping – related to the line 1 where the 18m long busses have been introduced)</i></p> <p><i>Before (year 2008) = 89,9% of trips</i>  <i>After (year 2011) = 90,6% of trips</i></p>	**
5	<p>To increase the number of passengers by 5% in the demo area.</p> <p><i>This objective is measured referring to the Line 1 of the bus network, which is the demo area that has been taken as reference. Looking at the data used for the calculation of indicator n.11, it's possible to see that the number of passengers on line 1 increased, but the target hasn't achieved; therefore this objective can be considered not achieved.</i></p> <p><i>From ind. 11 (average occupancy – related to the line 1 which is our demo area)</i>  <i>Before (year 2008) = 8'106'965 passengers</i>  <i>After (year 2011) = 8'179'108 passengers</i></p>	O
6	<p>To increase the km covered by CNG bus by more than 60%</p> <p><i>ind. 7 (% kms travelled by clean buses respect to the total amount of kms travelled by the fleet)</i>  <i>Before (year 2008) = 54,86 %</i>  <i>After (year 2011) = 73,37 %</i></p>	***
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full    *** = Exceeded</b></p>		

## **C4 Up-scaling of results**

The measure could be theoretically up-scaled as CNG buses are only one part of the fleet. However the complete reorganization of the bus network is foreseen, by 2013.

In this reorganisation of the network is supposed to maintain mainly the already existing clean fleet: CNG buses (including CNG buses bought during Civitas + 6 CNG buses already bought and no put into service yet) and Hybrid buses.

For sure “EURO 0+crt filter” buses will be substituted in the network reorganization therefore benefits related to the emissions are quantifiable as follows:

- NOx emission produced by CNG buses are 1/120 lower than “EURO 0+crt filter” buses
- Small particulate produced by CNG buses are 1/23 lower than “EURO 0+crt filter” buses

## **C5 Appraisal of evaluation approach**

The indicators were selected at the beginning of Civitas project and they were divided into different categories: Economy, Environment, Transport and Society.

The two indicators included in the category “Economy” were useful to manage the CBA for this measure. Several indicators were included in the Environment category in order to analyze the emissions related to the use of the renewed fleet.

Ind. N. 12 “environmental care” was selected in order to achieve the perception by the population, of the attention that BST give at the environment.

The indicators that estimate the whole emissions were useful to make several consideration in relation to the BaU and the up scaling construction. At the start up of the metro line by 2013 the fleet will be composed mainly by methane powered and hybrid busses, reducing significantly the total number of busses of the fleet.

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – There was a shifting from 45% of CNG busses/total fleet (in 2008) to 59% in 2011 and % Km travelled by clean buses respect to the total amount of kms travelled by the fleet, with an increasing of around 18% from 2008 to 2011, getting up to over 73% of Km travelled by CNG buses in 2011.
- **Key result 2** – Even if the fuel consumption and the gas emissions registered an overall worsening, if the only CNG component of the fleet is considered (which has been the actual object of the Civitas contribution), then the observed trend is opposite: the fuel consumption and the emissions decreased.
- **Key result 3** – Thanks to the measure implementation 20 CNG 18 metres busses have been purchased in order to minimize overcrowding on the busses (because of the increase of passengers); this objective is measured referring to the Line 1 of the existing bus network, as the 18m long busses run on that line. This goal can be considered achieved in full because

introducing longer vehicles, the busses capacity increased. Therefore, the average occupancy increased without worsening the bus overcrowding.

- **Key result 4** – Thanks to the use of longer vehicles (reducing trips and increasing seats), the bus frequency in the peak hour and also the passages in the city centre have been reduced; therefore the problem of the vehicles queuing could be considered solved problem. This objective is measured referring to the Line 1 of the bus network, as the 18m long busses are on that line.

## **C7 Future activities relating to the measure**

The possible activities related to the measure, which can be carried out at the end of Civitas are:

- The purchase of 6 new CNG buses was done during the last few days of the project (due to that they weren't financially reported in Civitas) and they are going to be equipped and than put into service by the end of the year.
- by the end of 2012 other 3 Diesel buses will be purchased and 5 old diesel buses will be dismissed.

These future activities are an important part of the company policy, carried out in years, in order to guarantee a more modern and competitive public transport service. This almost-consolidated tendency won't stop with the end of Civitas project; as a matter of fact the start up of the metro is foreseen in 2013, therefore it will be given a new image of public transport in Brescia.

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**D.**

## D Process Evaluation Findings

### D.0 Focused measure

This measure is a focused measure.

The reasons are the following:

- the possibility of carrying out a good Cost Benefit Analysis;
- the measure fits into the city policy towards sustainable urban transport and towards sustainability in general.

### D1 Deviations from the original plan

No significant deviation from the original work-plan was encountered, the only noteworthy exception consists in the reduction of the buses purchased,

In the last few days of the Civitas BST purchased other 6 new CNG buses (12m long) project. These buses haven't been financially reported in Civitas, therefore they haven't been included in the amount of buses purchased during the project.

### D2 Barriers and drivers

#### D2.1 Barriers

Process barriers are events or overlapping conditions that stimulates the process to obtain the measure objectives/goals as described in section A1 of this Measure Evaluation Report.

In the sequel main barriers, which have been picked out during the measure, are pointed out, in relation with the specific phase of the measure.

##### Implementation/operation phase

- **Barrier 1: Financial barrier – budget law -** Because of the “budget law” (“Patto di stabilità”) and the financial crisis, BST reduced the purchase of new buses.

##### Preparation phase

- **Barrier 2: Technological barriers - design -** the design of the road infrastructures has been a technological barrier; as a matter of fact, this one has caused problems for the 18 meters busses transit by particular intersections or roundabout.

#### D2.2 Drivers

In the sequel main drivers, which have been picked out during the measure, are pointed out:

Preparation/implementation phase

- **Driver 1: Political / strategic driver - needs** - Brescia Trasporti constant care for environment and mobility needs, led the company to increase the use of alternative fuels and of clean and energy efficient vehicles, in order to reduce pollution, exhaust gases, noise.
- **Driver 2: Involvement / communication driver - information** - Brescia Trasporti constant increase the level of the information (accessibility and up-grade) in order to promote public transport and to rationalize and improve the accessibility of the service.
- **Driver 3: Technological driver – alternative fuel** - The possibility of alternative fuels use, according the new technology offered and experimentation, has been an important driver for the city of Brescia and also for Brescia Trasporti.

## D2.3 Activities

Significant recovery action hasn't been necessary, as this measure is proceeding as scheduled in the project.

## D3 Participation

### D.3.1 Measure partners

The partners related to this measure are Brescia Trasporti and Brescia Municipality.

**Brescia Trasporti** is the transportation public company of the Municipality of Brescia, and has a well-know leadership at the national level in terms of a high-quality, competitive, modern transport service. Within the MODERN project, the role of Brescia Trasporti concerns the operation of the public transport service, the dissemination of the culture of sustainable mobility and the promotion of CNG fuel.

**Brescia Municipality** is involved in a series of integrated relationships with social actors present on the territory with the aim to design the development of the city and of its economy and welfare through an increasing participation of all the stakeholders and (as the maximum possible extent) of the citizens.

### D3.2 Participation of stakeholders

In this measure stakeholders are represented by **inhabitants** of the city of Brescia. Their direct involvement has been possible through administering them a four-monthly customer satisfaction survey, interviewing 1200 actual and potential users. An important event was organized on 19th February 2009: a presentation of the 20 new CNG busses to the authorities was done, by means of a press conference during a trial trip on the line 1. The municipality of Brescia has presented to the citizens the acquisition of the new clean busses, carried out thanks to Civitas funding. Another stakeholder is represented by the busses provider.

## **D4 Recommendations**

Based on the lessons learned from the implementation of the measure, the following recommendation can be drawn:

### **D.4.1 Recommendations: measure replication**

- **Recommendation 1: Action to Fleet renew** – in order to have more clean fleet, it's essential to act on buses (for example, through equipping existing vehicles with specific filters) or to purchase new ones to replace the older diesel powered ones.
- **Recommendation 2: Participation** – it's important to highlight the necessity of strong integration among measure implementation, information campaigns and measure monitoring, in order to make users aware of the reasons why the actions are undertaken (for example, a good level of information about the initiative carried out in Line 1 is important for users in order to better understand the reduction of buses frequency and not to see this one as a worsening of public transport service).

### **D.4.2 Recommendations: process**

- **Recommendation 3: good choice** – in Brescia has been purchased a km 0 bus already equipped but not as requested by Italian law in force; this choice penalized Brescia. Therefore it's recommended to keep attention to km 0 vehicles purchase.
- **Recommendation 4: geometry of roads** - is strongly recommended to consider the geometry of roads and intersections infrastructure before the purchase and putting into operation the busses.

## Annex 1: Data used for the BaU building

- **Indicator 1 (Average Operating revenues) and indicator 2 (Average operating cost).**

These indicators have no historical data series, therefore the BaU scenario has been built using other data series, such as the bus fleet composition (1996-2008) and the total number of total PT passengers (2005-2008).

### Bus fleet composition

years	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
methane gas powered						34	38	38	46	46	73	73	89
euro 2	4	4	30	32	32	32	37	37	36	36	36	42	38
euro 1	49	49	49	49	49	49	50	50	50	50	52	51	51
euro 1+crt filter													
euro 0	117	117	97	106	106	77	67	67	66	65	40	2	
euro 0+ crt filter												21	21
gasoline powered	4	4	4	4	4	4	4	4	4	4	4	3	
<b>TOT</b>	<b>174</b>	<b>174</b>	<b>180</b>	<b>191</b>	<b>191</b>	<b>196</b>	<b>196</b>	<b>196</b>	<b>202</b>	<b>201</b>	<b>205</b>	<b>192</b>	<b>199</b>

Total number of total PT passengers:

	Passengers
2005	38.008.558
2006	39.760.208
2007	41.459.439
2008	42.692.823

- **Indicator 3 (Vehicle fuel efficiency), Indicator 4 (CO emissions), Indicator 5 (Emissions), Indicator 6 (Small particulate emissions), Indicator 7 (% Km clean bus), Indicator 8 (NCG busses/total fleet)**

These indicators have no historical data series, therefore the BaU scenario has been built using other data series, such as the bus fleet composition (1996-2008) already reported at the previous bullet point (ind. 1 and 2)

- **Indicator 11 (Average occupancy)**

This indicator has no historical data series, therefore the BaU scenario has been built using other data series, such as the total number of passenger on the line 1 (2005-2008)

Year	Passengers on line 1
2005	6'910'885
2006	7'378'402
2007	7'635'049
2008	8'106'965

- **Indicator 12 (environmental care)**

The historical data series used for the calculation of the BaU is the judgment to the question included in the standard customer satisfaction survey “environmental care”

Survey date	Judgement to the question “environmental care”
Nov-04	5,9
May-05	5,98
Jul-05	6,63
Nov-05	6,45
May-06	6,12
Jul-06	5,9
Nov-06	6,24
May-07	7,11
Jul-07	6,87
Nov-07	6,83
May-08	6,79
Jul-08	7,08
Nov-08	7,19

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1 (AVERAGE OPERATING REVENUES)** – All data are related to each line. All the new 18 meters CNG buses are operated on Line 1; so only this Line will be investigated. CNG vehicle-km results from kilometres recorder reading, done monthly, even if the final report is annual. The data reliability is maximised due to an objective data collection. Ratio of total income generated from fares and tickets divided by the total vehicle-km per year.

$$A = B / C$$

where: A = Average operational revenue for the service (€/passengers)

B = Total operational revenue for the service, including revenues coming from tickets/fares sale (€)

C = Total passenger

EX ANTE SITUATION (year 2008):

**A= 0,269 €/passengers**

AFTER SITUATION:

year 2009: **A= 0, 259 €/passengers**

year 2010: **A= 0,257 €/passengers**

year 2011: **A= 0,281 €/passengers**

- **Indicator 2 (AVERAGE OPERATING COST)** – All data are related to each line. All the new 18 meters CNG buses are operated on Line 1; so only this Line will be investigated. CNG vehicle-km results from kilometres recorder reading, done monthly, even if the final report is annual. The data reliability is

maximised due to an objective data collection. Ratio of total operating costs incurred by the fleet (or line 1) divided by the total vehicle-km (or line 1) per year.

$$A = B / C$$

where: A = Average operational costs for the service (€/passengers)

B = Total operational costs for the service, including cost items related to raw materials/consumer goods (such as spare parts, fuel, lubricants, oils, tyres) and external services (such as maintenance costs for mechanics, body works, engines, gears, tyres, vehicles fee and electric energy) (€)

C = Total passengers

EX ANTE SITUATION: (year 2008)

**A = 0,585 €/passengers**

AFTER SITUATION:

year 2009: **A= 0, 572 €/passengers**

year 2010: **A= 0, 574 €/passengers**

year 2011: **A= 0, 613 €/passengers**

- **Indicator 3 – (VEHICLE FUEL EFFICIENCY)** - Provided data useful for the calculation of the indicator are the following:

A = Fuel consumption by type of vehicle (MJ);

B = Tot km travelled per year (vkm);

C = Number of vehicles by type (v)

**D = Vehicle fuel efficiency by type = A/(B\*C) (MJ/v\*vkm)**

The Fleet is composed by gas-oil busses and CNG busses; the gas-oil consume results come from the sum of the restocking done during the year (in depot are located tanks; after each load the data is recorded). The data of CNG consumes can be read on the counters located in the existing CNG station; the same data is also available in the manager's bills periodically recorded. This data are already periodically collected and elaborated once a year. Younger busses have new technologies that save fuel.

Period of data collection: **EX-ANTE** January-December 2008

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### Available data:

Vehicles: running fleet from January to December 2008 (tot 199 bus: 89 cng and 110 diesel)

Km: km travelled by fleet from January to December 2008. The km travelled by fleet are read from the bus tachygraph.

Fuel consumption: diesel and methane gas (lt/year) converted into MJ using calorific power for gasoil (41 MJ/kg) and for methane gas (34,45 MJ/mc).

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS	
Fuel type	gasoil	gasoil	gasoil	Methan gas	<b>TOTAL</b>
(C) N. bus (v)	21	51	38	89	<b>199</b>

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS	TOTAL
(B) Km travelled in 2008 (vkm)	745.367	1.769.299	1.318.801	4.658.436	<b>8.491.903</b>
Consumption factor (km/l)	2,0176	2,0176	2,0176	1,467	
Fuel consumption by type (l)	369.432	876.932	653.648	3.175.485	
Fuel consumption by type (kg or l)	308.476	732.239	545.796	3.175.485	
(A) Fuel consumption by type (MJ)	12.647.521	30.021.784	22.377.653	109.395.447	<b>Average (MJ/v*vkm)</b>
(D) Vehicle fuel efficiency (MJ/v*vkm) = A/(B*C)	<b>0,8080</b>	<b>0,3327</b>	<b>0,4465</b>	<b>0,2639</b>	<b>0,4628</b>

**AFTER DATA COLLECTION:**

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

### Period of data collection: January-December 2009

#### Available data:

Vehicles: running fleet from January to December 2009 (tot 195 bus: 110 CNG and 85 diesel)

Km: km travelled by fleet from January to December 2009. The km travelled by fleet are read from the bus tachygraph.

Fuel consumption: diesel and methane gas (l/year) converted into MJ using calorific power for gasoil (41 MJ/kg) and for methane gas (34,45 MJ/ m<sup>3</sup>).

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane bus	TOT
Fuel type	diesel	diesel	diesel	diesel	methane	
C = N. bus (v)	21	12	14	38	110	195

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	Bus METHANE GAS	TOTAL
(B) km travelled in 2009 (vkm)	520.811	470.463	508.843	1.199.516	5.558.100	8.257.733
Consumption factor (km/l)	2,0176	2,0176		2,0176	1,467	
Fuel consumption by type (Kg or l)	215.542	194.705	210.589	496.429	3.788.753	
(A) Fuel consumption by type (MJ)	8.837.215	7.982.901	8.634.140	20.353.603	130.522.526	Average (MJ/v*vkm)
(D) Vehicle fuel efficiency (MJ/v*vkm) = A/(B*C)	0,8080	1,4140	1,2120	0,4465	0,2135	0,8215

### Period of data collecting: January-December 2010

#### Available data:

Vehicles: running fleet from January to December 2010 (tot 194 bus: 110 CNG and 84 diesel)

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

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Km: km travelled by fleet from January to December 2010. The km travelled by fleet are read from the bus tachygraph.

Fuel consumption: diesel (lt/year); methane gas (m<sup>3</sup>/year) converted into MJ using calorific power for gasoil (41 MJ/kg) and for methane gas (34,45 MJ/mc).

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	methane	
<b>C) N. bus (v)</b>	<b>21</b>	<b>11</b>	<b>14</b>	<b>38</b>	<b>110</b>	<b>194</b>
% of tot bus	11%	6%	7%	20%	57%	

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	Bus METHANE GAS	TOTAL
<b>(B) km travelled in 2010 (vkm)</b>	<b>439.633</b>	<b>326.443</b>	<b>467.615</b>	<b>1.185.138</b>	<b>5.845.398</b>	<b>8.264.227</b>
Consumption Factor (km/l)	2,0176	2,0176	2,0176	2,0176	1,467	
Fuel consumption by type (l)	217.899	161.798	231.768	587.400	3.984.593	
Fuel consumption by type (kg or l)	181.946	135.101	193.526	490.479	3.984.593	
<b>(A) Fuel consumption by type (MJ)</b>	<b>7.459.772</b>	<b>5.539.144</b>	<b>7.934.575</b>	<b>20.109.635</b>	<b>137.269.230</b>	<b>Average (MJ/v*vkm)</b>
<b>(D) Vehicle fuel efficiency (MJ/v*vkm)</b>	<b>0,8080</b>	<b>1,5426</b>	<b>1,2120</b>	<b>0,4465</b>	<b>0,2135</b>	<b>0,8536</b>

### Period of data collecting: January-December 2011

Available data:

Vehicles: running fleet from January to December 2011 (tot 203 bus: 119 CNG and 84 diesel)

Km: km travelled by fleet from January to December 2011. The km travelled by fleet are read from the bus tachygraph.

Fuel consumption: diesel and methane gas l/year) converted into MJ using calorific power for gasoil (41 MJ/kg) and for methane gas (34,45 MJ/m<sup>3</sup>).

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Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1 +CRT	Atobus EURO 2	Atobus EURO 2+CRT	methane bus	TOTAL
Fuel type	diesel	diesel	diesel	diesel	diesel	methane	
C = N. bus (v)	21	11	14	9	29	<b>119</b>	<b>203</b>
% of tot bus	11%	6%	7%	4%	14	<b>59%</b>	

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	Atobus EURO 2+CRT	Bus METHANE GAS	TOTAL
(B) km travelled in 2011 (vkm)	416.351	222.225	419.223	149.254	951.163	<b>5.946.317</b>	<b>8.104.533</b>
Consumption Factor (km/l)	2,0176	2,0176	2,0176	2,0176	2,0176	1,467	
Fuel consumption by type (l)	206.360	110.143	207.783	73.976	471.433	4.053.386	
Fuel consumption by type (kg - l)	172.310	91.970	173.499	61.770	393.646	4.053.386	
(A) Fuel consumption by type MJ	7.064.719	3.770.754	7.113.451	2.532.569	16.139.505	139.639.142	<b>Average (MJ/ v*vkm)</b>
(D) Vehicle fuel efficiency (MJ/v*vkm)	<b>0,8080</b>	<b>1,5426</b>	<b>1,2120</b>	<b>1,8854</b>	<b>0,5851</b>	<b>0,1973</b>	<b>1,038</b>

- **Indicator 4 (CO EMISSIONS)** – In order to calculate the emissions data used are, in general: number of busses by type, kms travelled by fleet (read from the bus speedometer) referred to the emission standard (Euro 0, Euro 1, Euro 2, eev.), the fuel consumption per year by type (litres of gasoil and methane gas) and the emission factors provided by the Italian law according to the type of busses. This data are already collected and elaborated once a year.

Period of data collecting: **EX-ANTE** January-December 2008

The calculation of the CO emission has been performed using an internal model (similar to COPERT) based on fuel consumption by fleet from Jan to Dec 2008 and on the emission factors for the specific pollutant agent. The emission factors (expressed in g/kwh) also considered for the gasoil fleet are taken from

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European council directives which introduced the EURO standards emissions; The emission factor used for the methane gas fleet comes from the emission tests made by the manufacturer.

The detailed steps made in order to calculate the CO emissions per year are the following:

Calculation of CO emissions per year (kg)	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	369.432	876.932	653.648	3.175.485
Calorific power by type (kcal/l)	8.157	8.157	8.157	8.250
Kcal consumed by the fleet (kcal)	3.146.456.552	7.468.834.052	5.567.123.373	26.197.748.466
Kwh consumed by the fleet (kwh)	3.649.890	8.663.848	6.457.863	30.389.388
CO emission factors (g/kwh)	2,24	4,5	4	2,53
<b>CO emissions per year (kg)</b>	<b>8.176</b>	<b>38.987</b>	<b>25.831</b>	<b>76.885</b>

The main steps for the calculation of the indicator are the following:

Calculation of CO emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHANE GAS	FLEET AVERAGE
Number of vehicles (v)	21	51	38	89	
Km travelled by fleet per year (vkm)	745.367	1.769.299	1.318.801	4.658.436	
CO emissions per year (kg)	8.176	38.987	25.831	76.885	
<b>CO emissions (g/v*vkm)</b>	<b>0,5223</b>	<b>0,4321</b>	<b>0,5154</b>	<b>0,1854</b>	<b>0,4138</b>

### AFTER DATA COLLECTION:

#### Period of data collection: January-December 2009

The calculation of the CO emission has been performed using an internal model (similar to COPERT) based on fuel consumption by fleet from Jan to Dec 2009 and on the emission factors for the specific pollutant agent. The emission factors (expressed in g/kwh) also considered for the gasoil fleet are taken from European council directives which introduced the EURO standards emissions; the emission factor used for the methane gas fleet comes from the emission tests made by the manufacturer.

The detailed steps made in order to calculate the CO emissions per year are the following:

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

CO EMISSIONS	bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Bus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	258.134	233.180	252.202	594.526	3.788.753
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
kcal consumed by the fleet (kcal)	2.198.526.609	1.985.989.974	2.148.005.467	5.063.579.387	31.257.208.589
kwh consumed by the fleet (kwh)	2.550.291	2.303.748	2.491.686	5.873.752	36.258.362
CO emission factors (g/kwh)	2,24	4,50	0,90	4,00	2,53
CO emission per year (kg)	5.713	10.367	2.243	23.495	91.734

The main steps for the calculation of the indicator are the following:

Calculation of CO emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	12	14	38	110	
km travelled by fleet per year (kmv)	520.811	470.463	508.843	1.199.516	5.558.100	
CO emission per year (kg)	5.713	10.367	2.243	23.495	91.734	
CO emission (g/v*vkm)	0,5223	1,8363	0,3148	0,5154	0,1500	<b>0,6678</b>

### Period of data collection: January-December 2010

The calculation of the CO emission has been performed using an internal model (similar to COPERT) based on fuel consumption by fleet from Jan to Dec 2010 and on the emission factors for the specific pollutant agent. The emission factors (expressed in g/kwh) also considered for the gasoil fleet are taken from European council directives which introduced the EURO standards emissions; the emission factor used for the methane gas fleet comes from the emission tests made by the manufacturer.

The detailed steps made in order to calculate the CO emissions per year are the following:

Calculation of CO emission per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Bus EURO 2	Bus METHANE GAS

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Fuel consumption by type (l)	217.899	161.798	231.768	587.400	3.984.593
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
kcal consumed by the fleet (kcal)	1.855.845.688	1.378.030.844	1.973.967.563	5.002.884.787	32.872.892.638
kwh consumed by the fleet (kwh)	2.152.781	1.598.516	2.289.802	5.803.346	38.132.555
CO emission factors (g/kwh)	2,24	4,50	0,90	4,00	2,53
CO emission per year (kg)	4.822	7.193	2.061	23.213	96.475

The main steps for the calculation of the indicator are the following:

Calculation of CO emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	11	14	38	110	
km travelled by fleet per year (vkm)	439.633	326.443	467.615	1.185.138	5.845.398	
CO emission per year (kg)	4.822	7.193	2.061	23.213	96.475	
CO emission (g/v*vkm)	0,5223	2,0032	0,3148	0,5154	0,1500	<b>0,7011</b>

### Period of data collection: January-December 2011

The calculation of the CO emission has been performed using an internal model (similar to COPERT) based on fuel consumption by fleet from jan to dec 2011 and on the emission factors for the specific pollutant agent. The emission factors (expressed in g/kwh) also considered for the gasoil fleet are taken from European council directives which introduced the EURO standards emissions; The emission factor used for the methan gas fleet comes from the emission tests made by the manufacturer.

The detailed steps made in order to calculate the CO emissions per year are the following:

CO EMISSIONS	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Bus EURO 2	Bus EURO 2+CRT	Bus METHANE GAS
Fuel consumption by type (l)	206.360	110.143	207.783	73.976	471.433	4.053.386

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Calorific power by type (kcal/l)	8517	8517	8517	8517	8517	8250
kcal consumed by the fleet (kcal)	1.757.564.169	938.089.971	1.769.687.892	630.053.687	4.015.193.929	33.440.433.027
kwh consumed by the fleet (kwh)	2.038.774	1.088.184	2.052.838	730.862	4.657.625	38.790.902
CO emission factors (g/kwh)	2,24	4,50	0,90	4,00	0,80	2,53
CO emission per year (kg)	4.567	4.897	1.848	2.923	3.726	98.141

The main steps for the calculation of the indicator are the following:

Calculation of CO emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus EURO 2+CRT	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	11	14	9	29	<b>119</b>	
km travelled by fleet per year (vkm)	416.351	222.225	419.223	149.254	951.163	<b>5.946.317</b>	
CO emission per year (kg)	4.567	4.897	1.848	2.923	3.726	98.141	
CO emission (g/v*vkm)	0,5223	2,0032	0,3148	2,1763	0,1351	0,1387	<b>0,8817</b>

- **Indicator 5 (NOx EMISSIONS)**

### EX ANTE: (year 2008)

Below the main passages for the calculation of the NOx emissions per year (kg) and of the actual indicator are reported:

Calculation of NOx emissions per year (kg)	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS
Fuel consumption by type (l)	369.432	876.932	653.648	3.175.485
Calorific power by type (kcal/l)	8.157	8.157	8.157	8.250
Kcal consumed by the fleet (kcal)	3.146.456.552	7.468.834.052	5.567.123.373	26.197.748.466

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Kwh consumed by the fleet (kwh)	3.649.890	8.663.848	6.457.863	30.389.388
NOx emission factors (g/kwh)	14,4	8	7	0,38
<b>NOx emissions per year (kg)</b>	<b>52.558</b>	<b>69.311</b>	<b>45.205</b>	<b>11.548</b>

Calculation of NOx emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS	FLEET AVERAGE
Number of vehicles (v)	21	51	38	89	
Km travelled by fleet per year (vkm)	745.367	1.769.299	1.318.801	4.658.436	
NOx emissions per year (kg)	52.558	69.311	45.205	11.548	
<b>NOx emissions (g/v*vkm)</b>	<b>3,3578</b>	<b>0,7681</b>	<b>0,9020</b>	<b>0,0279</b>	<b>1,2639</b>

### AFTER DATA COLLECTION: (year 2009)

Calculation of NOx emission per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	258.134	233.180	252.202	594.526	3.788.753
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	2.198.526.609	1.985.989.974	2.148.005.467	5.063.579.387	31.257.208.589
Kwh consumed by the fleet (kwh)	2.550.291	2.303.748	2.491.686	5.873.752	36.258.362
NOx emission factors (g/kwh)	14,40	8,00	8,00	7,00	0,38
<b>NOx emissions per year (kg)</b>	<b>36.724</b>	<b>18.430</b>	<b>19.933</b>	<b>41.116</b>	<b>13.778</b>

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Calculation of NOx emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	12	14	38	110	
km travelled by fleet per year (vkm)	520.811	470.463	508.843	1.199.516	5.558.100	
NOx emission per year (kg)	36.724	18.430	19.933	41.116	13.778	
<b>NOx emission (g/v*vkm)</b>	<b>3,3578</b>	<b>3,2645</b>	<b>2,7982</b>	<b>0,9020</b>	<b>0,0225</b>	<b>2,069</b>

(year 2010)

Calculation of NOx emission per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	217.899	161.798	231.768	587.400	3.984.593
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	1.855.845.688	1.378.030.844	1.973.967.563	5.002.884.787	32.872.892.638
Kwh consumed by the fleet (kwh)	2.152.781	1.598.516	2.289.802	5.803.346	38.132.555
NOx emission factors (g/kwh)	14,40	8,00	8,00	7,00	0,38
<b>NOx emissions per year (kg)</b>	<b>31.000</b>	<b>12.788</b>	<b>18.318</b>	<b>40.623</b>	<b>14.490</b>

Calculation of NOx emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS
number of vehicles (v)	21	11	14	38	110
km travelled by fleet per year (vkm)	439.633	326.443	467.615	1.185.138	5.845.398
NOx emission per year (kg)	31.000	12.788	18.318	40.623	14.490
<b>NOx emission (g/v*vkm)</b>	<b>3,3578</b>	<b>3,5613</b>	<b>2,7982</b>	<b>0,9020</b>	<b>0,0225</b>

(year 2011)

Calculation of NOx emission per year (kg)	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Atobus EURO 2+CRT	Bus METHANE GAS

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Fuel consumption by type (l)	206.360	110.143	207.783	73.976	471.433	4.053.386
Calorific power by type (kcal/l)	8517	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	1.757.564.169	938.089.971	1.769.687.892	630.053.687	4.015.193.929	33.440.433.027
Kwh consumed by the fleet (kwh)	2.038.774	1.088.184	2.052.838	730.862	4.657.625	38.790.902
NOx emission factors (g/kwh)	14,40	8,00	8,00	7,00	7,00	0,38
<b>NOx emissions per year (kg)</b>	<b>29.358</b>	<b>8.705</b>	<b>16.423</b>	<b>5.116</b>	<b>32.603</b>	<b>14.741</b>

Calculation of NOx emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Atobus EURO 2+CRT	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	11	14	9	29	<b>119</b>	
km travelled by fleet per year (vkm)	416.351	222.225	419.223	149.254	951.163	5.946.317	
NOx emission per year (kg)	29.358	8.705	16.423	5.116	32.603	14.741	
<b>NOx emission (g/v*vkm)</b>	<b>3,3578</b>	<b>3,5613</b>	<b>2,7982</b>	<b>3,8086</b>	<b>1,1820</b>	<b>0,0208</b>	<b>2,4548</b>

- Indicator 6 (SMALL PARTICULATE EMISSIONS)**

EX ANTE: (year 2008)

Below the main passages for the calculation of the NOx emissions per year (kg) and of the actual indicator are reported:

Calculation of SP emissions per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS
Fuel consumption by type (l)	369.432	876.932	653.648	3.175.485
Calorific power by type (kcal/l)	8.157	8.157	8.157	8.250
Kcal consumed by the fleet (kcal)	3.146.456.552	7.468.834.052	5.567.123.373	26.197.748.466
Kwh consumed by the fleet (kwh)	3.649.890	8.663.848	6.457.863	30.389.388
SP emission factors (g/kwh)	0,02	0,36	0,15	0,003

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

<b>SP emissions per year (kg)</b>	<b>73</b>	<b>3 119</b>	<b>969</b>	<b>91</b>
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Calculation of SP emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 2	Bus METHAN GAS	FLEET AVERAGE
Number of vehicles (v)	21	51	38	89	
Km travelled by fleet per year (vkm)	745.367	1.769.299	1.318.801	4.658.436	
SP emissions per year (kg)	73	3 119	969	91	
<b>SP emissions (g/v*vkm)</b>	<b>0,0047</b>	<b>0,0346</b>	<b>0,0193</b>	<b>0,0002</b>	<b>0,0147</b>

### AFTER DATA COLLECTION:

(year 2009)

Calculation of SP emission per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	258.134	233.180	252.202	594.526	3.788.753
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	2.198.526.609	1.985.989.974	2.148.005.467	5.063.579.387	31.257.208.589
Kwh consumed by the fleet (kwh)	2.550.291	2.303.748	2.491.686	5.873.752	36.258.362
SP emission factors (g/kwh)	0,020	0,360	0,020	0,150	0,003
<b>SP emission per year (kg)</b>	<b>51</b>	<b>829</b>	<b>50</b>	<b>881</b>	<b>109</b>

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Calculation of NOx emission (g/vkm)	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	12	14	38	110	
km travelled by fleet per year (vkm)	520.811	470.463	508.843	1.199.516	5.558.100	
SP emission per year (kg)	51	829	50	881	109	
<b>SP emission (g/v*vkm)</b>	<b>0,0047</b>	<b>0,1469</b>	<b>0,0070</b>	<b>0,0193</b>	<b>0,0002</b>	<b>0,0356</b>

(year 2010)

Calculation of SP emission per year	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS
Fuel consumption by type (l)	217.899	161.798	231.768	587.400	3.984.593
Calorific power by type (kcal/l)	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	1.855.845.688	1.378.030.844	1.973.967.563	5.002.884.787	32.872.892.638
Kwh consumed by the fleet (kwh)	2.152.781	1.598.516	2.289.802	5.803.346	38.132.555
SP emission factors (g/kwh)	0,020	0,360	0,020	0,150	0,003
<b>SP emission per year (kg)</b>	<b>43</b>	<b>575</b>	<b>46</b>	<b>871</b>	<b>114</b>

Calculation of SP emission	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	11	14	38	110	
km travelled by fleet per year (vkm)	439.633	326.443	467.615	1.185.138	5.845.398	
SP emission per year (kg)	43	575	46	871	114	

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

<b>SP emission (g/v*vkm)</b>	0,0047	0,1603	0,0070	0,0193	0,0002	<b>0,0383</b>
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(year 2011)

Calculation of SP emission per year (kg)	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Atobus EURO 2+CRT	Bus METHANE GAS
Fuel consumption by type (l)	206.360	110.143	207.783	73.976	471.433	4.053.386
Calorific power by type (kcal/l)	8517	8517	8517	8517	8517	8250
Kcal consumed by the fleet (kcal)	1.757.564.169	938.089.971	1.769.687.892	630.053.687	4.015.193.929	33.440.433.027
Kwh consumed by the fleet (kwh)	2.038.774	1.088.184	2.052.838	730.862	4.657.625	38.790.902
SP emission factors (g/kwh)	0,020	0,360	0,020	0,150	0,220	0,003
<b>SP emission per year (kg)</b>	<b>41</b>	<b>392</b>	<b>41</b>	<b>110</b>	<b>1.025</b>	<b>116</b>

Calculation of SP emissions	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus EURO 2+CRT	Bus METHANE GAS	FLEET AVERAGE
number of vehicles (v)	21	11	14	9	29	<b>119</b>	
km travelled by fleet per year (vkm)	416.351	222.225	419.223	149.254	951.163	5.946.317	
SP emission per year (kg)	41	392	41	110	1.025	116	
<b>SP emission (g/v*vkm)</b>	<b>0,0047</b>	<b>0,1603</b>	<b>0,0070</b>	<b>0,0816</b>	<b>0,0371</b>	<b>0,0002</b>	<b>0,0485</b>

- Indicator 7 (% KM CLEAN BUS)** – It's the percentage between the cover clean km and the total km. Both the data are read from the bus tachygraph.  
 Period of data collecting:  
**EX-ANTE** January-December 2008  
 Kilometres travelled by CNG bus and electrical bus from Jan. to Dec. 2008 in relation to the total kilometres.

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

Mileage and fuel consumption	Autobus EURO 0+crt	Autobus EURO 1	Atobus EURO 2	Autobus a METANO	TOTALE (KM/ANNO)
km traveled in 2008	745.367	1.769.299	1.318.801	4.658.436	<b>8.491.903</b>
% of tot km	8,78%	20,84%	15,53%	54,86%	

### AFTER DATA COLLECTION:

(year 2009)

Kilometres travelled by CNG bus and electrical bus from Jan to Dec 2009 in relation to the total kilometers.

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Bus METHANE GAS	TOT (km/year)
km travelled in 2009	520.811	470.463	508.843	1.199.516	<b>5.558.100</b>	<b>8.257.733</b>
% of tot km	6,31%	5,70%	6,16%	14,53%	67,31%	

(year 2010)

Kilometres travelled by CNG bus and electrical bus from Jan to Dec 2010 in relation to the total kilometers.

Mileage and fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Bus EURO 2	Bus METHANE GAS	TOT (km/year)
km travelled in 2010	439.633	326.443	467.615	1.185.138	<b>5.845.398</b>	<b>8.264.227</b>
% of tot km	5,32%	3,95%	5,66%	14,34%	70,73%	

(year 2011)

Mileage and Fuel consumption	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+crt	Atobus EURO 2	Atobus EURO 2+CRT	Bus METHANE GAS	TOT (km/year)

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

km travelled in 2011	416.351	222.225	419.223	149.254	951.163	<b>5.946.317</b>	<b>8.104.533</b>
% of tot km	5,14%	2,74%	5,17%	1,84%	11,74%	<b>73,37%</b>	

- Indicator 8 (N. CLEAN BUSES)**

### EX-ANTE January-December 2008

Number of CNG bus and electrical bus from Jan to Dec 2008 in relation to the total fleet.

Fleet composition	Autobus EURO 0+crt	Autobus EURO 1	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	<b>methane</b>	
N. autobus	21	51	38	<b>89</b>	<b>199</b>
% of tot bus	11%	26%	19%	<b>45%</b>	

### AFTER DATA COLLECTION:

(year 2009)

Period of data collection: January-December 2009

Number of CNG bus and electrical bus from Jan to Dec 2009 in relation to the total fleet.

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	<b>methane</b>	
N. bus	21	12	14	38	<b>110</b>	<b>195</b>
% of tot bus	10%	6%	7%	19%	<b>56%</b>	

Measure title:

## CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number:

**01.06**

**(year 2010)**

Period of data collecting: January-December 2010

Number of CNG bus and electrical bus from Jan to Dec 2010 in relation to the total fleet.

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	methane	
N. bus	21	11	14	38	110	194
% of tot bus	10%	5%	7%	20%	57%	

**(year 2011)**

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	Atobus EURO 2+CRT	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	diesel	methane	
N. bus	21	11	14	9	29	119	203
% of tot bus	10%	5%	7%	4%	15%	59%	

- **Indicator 9 (NOISE PERCEPTION) –**

EX ANTE: (year 2008) **the measure is referred to all the busses of the fleet**

Measurement of noise perception for a bus driver at work. Average sound level = 72,8 db(A) (maximum 80 db(A) according to D.L. n.81 of 9/4/2008 title VIII cap I e II)

**AFTER DATA COLLECTION:**

**(year 2009); the measure is referred only to 18mt busses**

Average sound level = 72,5 db(A) (maximum 80 db(A) according to D.L. n.81 of 9/4/2008 title VIII cap I e II)

**(year 2010); the measure is referred only to 18mt busses**

The same of 2009, because no new busses are acquired  
(year 2011); the measure isn't repeated.

- **Indicator 10 (Accuracy of time keeping)** - Number of percentage of PT on line1 that arrive within an acceptable interval (3min) around the planned times given by timetable. Data are monthly collected by the tele-data collector. Only downtown passes are detected. Accuracy of time keeping of line 1 will be investigated for the bus stops located in the city centre.

2008	Measurement point code		tot trips	Recorded trips	%
Line1					
Jan	OSP	MBEL	1559	1426	91,5%
	STA	MAZ	1546	1442	93,3%
Feb	OSP	MBEL	2352	2093	89,0%
	STA	MAZ	2307	2027	87,9%
Mar	OSP	MBEL	2025	1922	94,9%
	STA	MAZ	1995	1821	91,3%
Apr	OSP	MBEL	2689	2547	94,7%
	STA	MAZ	2639	2383	90,3%
may	OSP	MBEL	1071	1008	94,1%
	STA	MAZ	1056	968	91,7%
Jun	OSP	MBEL	1845	1680	91,1%
	STA	MAZ	1816	1612	88,8%
Jul	OSP	MBEL	1905	1802	94,6%
	STA	MAZ	1894	1766	93,2%
Ago	OSP	MBEL	1408	1313	93,3%
	STA	MAZ	1363	1179	86,5%
Sep	OSP	MBEL	2619	2417	92,3%
	STA	MAZ	2569	2226	86,6%
Oct	OSP	MBEL	2938	2640	89,9%
	STA	MAZ	2902	2449	84,4%
Nov	OSP	MBEL	2575	2278	88,5%
	STA	MAZ	2564	2177	84,9%
Dec	OSP	MBEL	1771	1525	86,1%
	STA	MAZ	1753	1366	77,9%

Average time keeping accuracy 89,9%

**AFTER DATA COLLECTION:**

(year 2009);

2009			Tot bus rides	Bus rides on schedule	%
Line 1					
<b>Jan</b>	OSP	MBEL	2359	2191	92,9%
	STA	MAZ	2321	2052	88,4%
<b>Feb</b>	OSP	MBEL	2607	2402	92,1%
	STA	MAZ	2584	2287	88,5%
<b>Mar</b>	OSP	MBEL	1983	1492	75,2%
	STA	MAZ	2002	1733	86,6%
<b>Apr</b>	OSP	MBEL	1649	1491	90,4%
	STA	MAZ	1642	1455	88,6%
<b>May</b>	OSP	MBEL	1803	1606	89,1%
	STA	MAZ	1802	1564	86,8%
<b>Jun</b>	OSP	MBEL	1655	1463	88,4%
	STA	MAZ	1630	1324	81,2%
<b>Jul</b>	OSP	MBEL	1597	1329	83,2%
	STA	MAZ	1554	1109	71,4%
<b>Aug</b>	OSP	MBEL	1428	1308	91,6%
	STA	MAZ	1360	1104	81,2%
<b>Sep</b>	OSP	MBEL	1858	1669	89,8%
	STA	MAZ	1829	1477	80,8%
<b>Oct</b>	OSP	MBEL	1892	1690	89,3%
	STA	MAZ	1914	1658	86,6%
<b>Nov</b>	OSP	MBEL	1796	1665	92,7%
	STA	MAZ	1803	1536	85,2%
<b>Dec</b>	OSP	MBEL	1214	1072	88,3%
	STA	MAZ	1214	993	81,8%

Average time keeping accuracy 86,3%

# CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

(year 2010);

2010			Tot bus rides	Bus rides on schedule	%
Line 1					
Jan	OSP	MBEL	1352	1261	93,30%
	STA	MAZ	1350	1205	89,30%
Feb	OSP	MBEL	1670	1557	93,20%
	STA	MAZ	1684	1505	89,40%
Mar	OSP	MBEL	2050	1925	93,90%
	STA	MAZ	2072	1908	92,10%
Apr	OSP	MBEL	1624	1546	95,20%
	STA	MAZ	1642	1475	89,80%
May	OSP	MBEL	1851	1717	92,80%
	STA	MAZ	1829	1619	88,50%
Jun	OSP	MBEL	1580	1414	89,50%
	STA	MAZ	1621	1340	82,70%
Jul	OSP	MBEL	944	850	90,00%
	STA	MAZ	957	787	82,20%
Aug	OSP	MBEL	1276	1218	95,50%
	STA	MAZ	1267	1151	90,80%
Sep	OSP	MBEL	1834	1640	89,40%
	STA	MAZ	1857	1604	86,40%
Oct	OSP	MBEL	1861	1680	90,30%
	STA	MAZ	1883	1685	89,50%
Nov	OSP	MBEL	1785	1629	91,30%
	STA	MAZ	1820	1621	89,10%
Dec	OSP	MBEL	1602	1432	89,40%
	STA	MAZ	1626	1413	86,90%

Average time keeping accuracy 90,0%

(year 2011);

2011			Tot bus rides	Bus rides on schedule	%
Line 1					
Jan	OSP	MBEL	1651	1562	94,60%
	STA	MAZ	1675	1555	92,80%
Feb	OSP	MBEL	1670	1576	94,40%

2011			Tot bus rides	Bus rides on schedule	%
Line 1					
	STA	MAZ	1684	1553	92,20%
<b>Mar</b>	OSP	MBEL	1874	1778	94,90%
	STA	MAZ	1900	1752	92,20%
<b>Apr</b>	OSP	MBEL	1496	1401	93,60%
	STA	MAZ	1493	1349	90,40%
<b>May</b>	OSP	MBEL	1928	1809	93,80%
	STA	MAZ	1944	1788	92,00%
<b>Jun</b>	OSP	MBEL	1656	1495	90,30%
	STA	MAZ	1659	1442	86,90%
<b>Jul</b>	OSP	MBEL	1411	1273	90,20%
	STA	MAZ	1418	1197	84,40%
<b>Aug</b>	OSP	MBEL	1306	1230	94,20%
	STA	MAZ	1292	1144	88,50%
<b>Sep</b>	OSP	MBEL	1800	1591	88,40%
	STA	MAZ	1790	1503	84,00%
<b>Oct</b>	OSP	MBEL	1835	1643	89,50%
	STA	MAZ	1848	1644	89,00%
<b>Nov</b>	OSP	MBEL	1771	1601	90,40%
	STA	MAZ	1797	1616	89,90%
<b>Dec</b>	OSP	MBEL	1645	1475	89,70%
	STA	MAZ	1646	1468	89,20%

Average time keeping accuracy 90,6%

- **Indicator 11 (AVERAGE OCCUPANCY)** - Passengers per trip of Line 1. Number of passengers recorded + 60min ticket recorded per trip in the given period (3monthly). Data are monthly collected according to the number of passes recorded and 60min ticket issued considering a coefficient related to different elements such as missing ticket validation (as Regione Lombardia's law)

passengers on line 1 (Jan-Dec 2008) = 8.106.965

trips on line 1 (Jan-Dec 2008) = 93303

Average occupancy = 86,89

**AFTER DATA COLLECTION:****(year 2009);**

passengers on line 1 (Jan-Dec 2009) = 8.202.951

trip on line 1 (Jan-Dec 2009) = 80.626

Average occupancy = 101,74

**(year 2010);**

passengers on line 1 (Jan-Dec 2010) = 8.286.081

trip on line 1 (Jan-Dec 2010) = 74.741

Average occupancy = 110,86

**(year 2011);**

passengers on line 1 (Jan-Dec 2011) = 8.179.108

trip on line 1 (Jan-Dec 2011) = 74.102

Average occupancy = 110,38

- **Indicator 12 (ENVIRONMENTAL CARE)** – The data is collected in Customer Satisfaction questionnaires. The data is general and collected in Customer Satisfaction questionnaires each 4 months with interviews to the users. The related question is: "Brescia Trasporti takes care for the pollution's reduction. "The interview amount is 1200. The people interviewed are chosen in a double way: interviews at the bus stop and phone interviews. For the interviews at the bus stops, the bus stops are selected with a particular focus on terminals or on specific lines; for the phone interviews a casual extraction among the people registered in the lists of the holders of Omnibus Card is made according to the typology of trip loaded. 700 questions are proposed face to face at the bus stops and/or on the busses of Brescia Trasporti and 500 are proposed by phone interview according to the references of Brescia Trasporti. The activity has been planned associating traditional surveys (structured questions, semi structured and open ones) and innovative methodologies tested by Summa that allows to manage the information coming from indirect survey. According with the methodologies used, the witness is able to express its position or opinion about certain subject without preconceived answers and taking over all content delivered spontaneously. The obtained indications are introduced into a dynamic database and analyzed carefully, focusing on key concepts and on the additional ones, and it is possible to draw assessments and rigorous statistics, qualitative in-depth. Specific interviews will probably be carried out for Civitas MODERN trough dedicated surveys to better understand the result of all measure concerning PT implementation.

Result of customer satisfaction 2008/I : 6,79/10

Result of customer satisfaction 2008/II : 7,08/10

Result of customer satisfaction 2008/III : 7,19/10

Result of customer satisfaction 2008/I – Specific question about BST attention to pollution

Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

100% totale soggetti interpellati

▶ 99,6% esprime il livello di soddisfazione in relazione agli indicatori precodificati

▶ 100% valuta l'attenzione di Brescia Trasporti per la riduzione dell'inquinamento

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>172</b>	<b>14,1</b>
Soddisfatto	<b>471</b>	<b>38,7</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>310</b>	<b>25,5</b>
Insoddisfatto	<b>191</b>	<b>15,7</b>
Molto insoddisfatto	<b>72</b>	<b>5,9</b>

Punteggio sintetico in base 10 **6,79**Deviazione standard (±) **2,18** Errore standard (±) **0,063****Result of customer satisfaction 2008/II - Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

100% totale soggetti interpellati

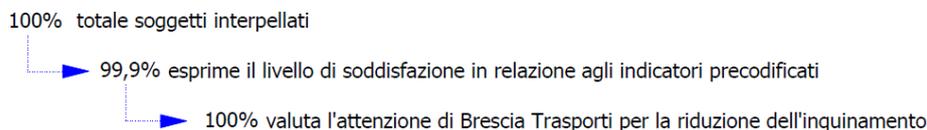
▶ 99,9% esprime il livello di soddisfazione in relazione agli indicatori precodificati

▶ 100% valuta l'attenzione di Brescia Trasporti per la riduzione dell'inquinamento

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>189</b>	<b>15,6</b>
Soddisfatto	<b>547</b>	<b>45,1</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>274</b>	<b>22,6</b>
Insoddisfatto	<b>140</b>	<b>11,6</b>
Molto insoddisfatto	<b>62</b>	<b>5,1</b>

Punteggio sintetico in base 10 **7,08**Deviazione standard (±) **2,10** Errore standard (±) **0,060**

**Result of customer satisfaction 2008/III - Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

## Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>194</b>	<b>15,6</b>
Soddisfatto	<b>536</b>	<b>43,2</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>353</b>	<b>28,4</b>
Insoddisfatto	<b>128</b>	<b>10,3</b>
Molto insoddisfatto	<b>30</b>	<b>2,4</b>

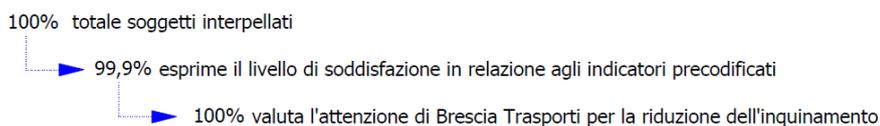
Punteggio sintetico in base 10 **7,19**Deviazione standard (±) **1,90** Errore standard (±) **0,054****AFTER DATA COLLECTION:****(year 2009);**

Result of customer satisfaction 2009/I : 7,04/10

Result of customer satisfaction 2009/II : 7,33/10

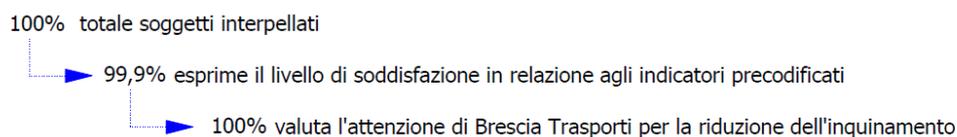
Result of customer satisfaction 2009/III : 7,04/10

Result of customer satisfaction 2009/I – Specific question about BST attention to pollution

Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

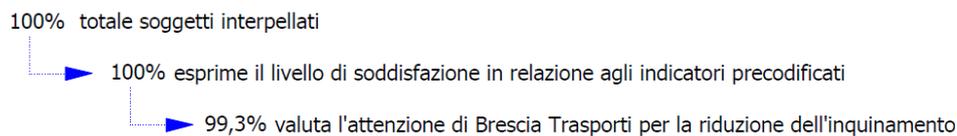
elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>175</b>	<b>14,3</b>
Soddisfatto	<b>497</b>	<b>40,7</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>382</b>	<b>31,3</b>
Insoddisfatto	<b>124</b>	<b>10,1</b>
Molto insoddisfatto	<b>44</b>	<b>3,6</b>

Punteggio sintetico in base 10 **7,04**Deviazione standard (±) **1,96** Errore standard (±) **0,056****Result of customer satisfaction 2009/II - Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>255</b>	<b>20,9</b>
Soddisfatto	<b>543</b>	<b>44,4</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>233</b>	<b>19,1</b>
Insoddisfatto	<b>141</b>	<b>11,5</b>
Molto insoddisfatto	<b>50</b>	<b>4,1</b>

Punteggio sintetico in base 10 **7,33**Deviazione standard (±) **1,96** Errore standard (±) **0,056**

**Result of customer satisfaction 2009/III - Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>125</b>	<b>10,2</b>
Soddisfatto	<b>539</b>	<b>44,2</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>442</b>	<b>36,2</b>
Insoddisfatto	<b>74</b>	<b>6,1</b>
Molto insoddisfatto	<b>40</b>	<b>3,3</b>

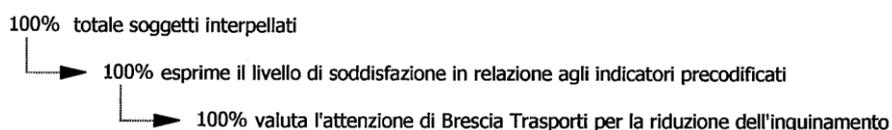
Punteggio sintetico in base 10 **7,04**Deviazione standard ( $\pm$ ) **1,76** Errore standard ( $\pm$ ) **0,050**

**(year 2010);**

Result of customer satisfaction 2010/I : 7,33

Result of customer satisfaction 2010/II : 7,27

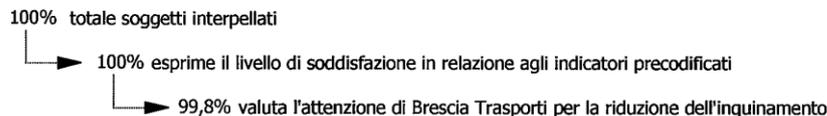
Result of customer satisfaction 2010/III : 7,19

**Result of customer satisfaction 2010/I – Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

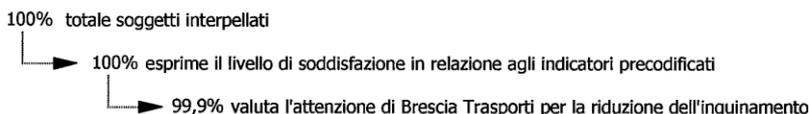
elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>212</b>	<b>17,5</b>
Soddisfatto	<b>562</b>	<b>46,5</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>294</b>	<b>24,3</b>
Insoddisfatto	<b>99</b>	<b>8,2</b>
Molto insoddisfatto	<b>42</b>	<b>3,5</b>

Punteggio sintetico in base 10 **7,33**Deviazione standard (±) **1,95** Errore standard (±) **0,056****Result of customer satisfaction 2010/II - Specific question about BST attention to pollution**

Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>180</b>	<b>15,0</b>
Soddisfatto	<b>608</b>	<b>50,5</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>261</b>	<b>21,7</b>
Insoddisfatto	<b>105</b>	<b>8,7</b>
Molto insoddisfatto	<b>50</b>	<b>4,2</b>

Punteggio sintetico in base 10 **7,27**Deviazione standard (±) **1,96** Errore standard (±) **0,056****Result of customer satisfaction 2010/III - Specific question about BST attention to pollution**Tavola 9 **Indicatore 8: attenzione di Brescia Trasporti per la riduzione dell'inquinamento**

Il grado di soddisfazione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)
Molto soddisfatto	<b>168</b>	<b>14,0</b>
Soddisfatto	<b>517</b>	<b>43,0</b>
Indifferente (né soddisfatto, né insoddisfatto)	<b>401</b>	<b>33,4</b>
Insoddisfatto	<b>89</b>	<b>7,4</b>
Molto insoddisfatto	<b>26</b>	<b>2,2</b>

Punteggio sintetico in base 10 **7,19**Deviazione standard (±) **1,79** Errore standard (±) **0,052**

Result of customer satisfaction 2011/I : 7,54

Result of customer satisfaction 2011/II : 7,27

Result of customer satisfaction 2011/III : 7,10

## Result of customer satisfaction 2011 - Specific question about BST attention to pollution

- **Indicator 13 (AVERAGE FLEET AGE)** – Collected data for the ex ante are referred to December 2008. This indicator is linked to the indicator number 3 “Vehicle fuel efficiency”, as younger busses have new technologies that save fuel.

Period of data collecting: December 2008

Average fleet age:

Fleet composition	Autobus EURO 0+crt	Autobus EURO 1	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	methane	
N. autobus	21	51	38	89	199
EVERAGE AGE	9 years				

### AFTER DATA COLLECTION:

(year 2009)

Average age of the fleet in December 2009 calculated in accordance with the regional indicative.

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane gas	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	methane	
N. bus	21	12	14	38	110	195
% of tot bus	11%	6%	7%	19%	56%	
EVERAGE AGE	8,4 years					

(year 2010)

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	methane	
N. bus	21	11	14	38	110	194
% of tot bus	11%	6%	7%	20%	57%	
EVERAGE AGE	9,3 years					

(year 2011)

Measure title:

# CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **01.06**

Fleet composition	Bus EURO 0+crt	Bus EURO 1	Bus EURO 1+CRT	Atobus EURO 2	Atobus EURO 2+CRT	methane bus	TOT (N)
Fuel type	diesel	diesel	diesel	diesel	diesel	methane	
N. bus	21	11	14	9	29	119	203
% of tot bus	11%	6%	7%	5%		61%	
EVERAGE AGE	9,9 years						

## Annex 3: Cost Benefit Analysis

### Evaluation period for CBA

The whole CBA is referred to the fleet running on Line 1, on which thanks to Civitas only CNG 18m long buses are used, The purchased hybrid (methane-electric) 8 long buses are used for the on demand service "Accabus" (for disabled/elder people), for the Bussola service (which links two peripheral parking) and for the bus service in the smallest downtown roads.

The present costs/benefits analysis (CBA) is referred to the Line 1 (Mompiano-Masaccio) of Brescia local public transport system. In fact, since 2009 on line 1 only the new 18 m CNG buses (length: 18 m; capacity: 149 passengers of which 32 seats) are in use. The CBA base year is 2008, during which on Line 1 20 buses were in use. After 2009, the transport offer (buses\*km) is unchanged. The CBA final year (2023) falls at the end of the technical/economical life span of the busses (that doesn't necessary coincide with the average age of a fleet, that is usually estimated in 15 years).

### Method and values for modification

This CBA doesn't contemplate oncoming Brescia Trasporti strategy on the occasion of the Metrobus start up foreseen in January 2013, after which Brescia buses transport system is going to be modified.

On line 1 now only the new 18 m CNG buses (length: 18 mt; capacity: 149 passengers of which 32 seats) are in use (length: 12 m; capacity: 91 passengers of which 24 seats), but in the base-year 2008, 20 buses were in use (see Table 1), with different feeding: diesel (Euro0+crt, Euro1, Euro2) or CNG. In particular, for the scenario 0 building (BaU) the buses partition into the different categories has been arranged proportionally to the 2008 whole fleet, as shown in Table 1.

TABLE 1 – Estimated types and number of buses operating on line 1 in 2008

	2008							
	Urban network fleet				Line 1 fleet			
	N. buses	%	Km	%	N. buses	Km	Av.ate (years)	Dead year
Euro0+crt Buses	21	10,6%	745.367	8,8%	2	96.228	17	2009
Euro1 Buses	51	25,6%	1.769.299	20,8%	5	228.420	13	2010
Euro2 Buses	38	19,1%	1.318.801	15,5%	4	170.260	11	2012
Methane Buses (length: 12 m)	89	44,7%	4.658.436	54,9%	9	601.413	4	2019
<b>TOTAL</b>	<b>199</b>	<b>100,0%</b>	<b>8.491.903</b>	<b>100,0%</b>	<b>20</b>	<b>1.096.321</b>	<b>9</b>	<b>-</b>

Source: Brescia Mobilità SpA

As a consequence of the new 18 m CNG buses use on line 1, polluting emissions and maintenance costs are decreased: in fact, runs have been reduced from 1.096.321 km to 921.576 km. Therefore, CBA has to consider the investment costs of new CNG buses and the emission/maintenance costs variation. Other operating cost (as bus drivers, for example) are considered unchanged.

The benefits, due to the passengers increase and to the CNG buses, which have less environmental impact, can equal (conventionally) the operating revenues increase (financial aspect assimilated to economical aspect).

The main economic items calculated, referring to base year, are:

- Net Present Value (NPV);
- B/C ratio;
- Investment Return Rate (IRR).

The buses polluting emission data are shown in Table 2, subdivided into different bus types, used in the CBA scenarios (diesel Euro0+crt; diesel Euro1, diesel Euro2, methane). The units of measurements are grams of carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM), referred to 1 kilowatt-hour energy consumption.

On first approximation, polluting emission quantities have been assumed the same for the different methane bus types (12 m and 18 m length).

TABLE 2 – Polluting emission factors of different bus types used in CBA

<b>EMISSION FACTOR</b>	<b>EURO0+crt</b>	<b>EURO1</b>	<b>EURO2</b>	<b>METHANE</b>
CO emission factor (g/kWh)	2,24	4,50	4,00	2,53
NOx emission factor (g/kWh)	14,40	8,00	7,00	0,38
PM emission factor (g/kWh)	0,02	0,36	0,15	0,003

Source: Brescia Mobilità – EURO Normative

The monetization of environmental benefits has been carried out basing on EU data, as agreed during the last Civitas meeting in Funchal; in particular, the main polluting agents (CO, NOx, PM) data (total external costs in urban zone), considered in CBA, are shown in Table 3 and are referred to Euro 2008.

TABLE 3 – Monetization of the main polluting agents (€2008/Kg)

<b>EMISSION TYPE</b>	<b>ESTERNAL COST (€2008/kg)</b>
CO emission (*)	0,003
NOx emission (**)	3,639
PM emission (**)	420,763

Source: (\*) Astra – Scenario Low External Cost - 2005

(\*\*) HEATCO, D5 Proposal for harmonised Guidelines – Brussels, 2006

## Scenario 0 (Reference case or BaU)

In this scenario the Brescia Trasporti public transport system and the buses types used in 2008 on Line 1 have been considered unchanged up to the technical/economic life relevant limits. The original buses are replaced with new CNG buses (length: 12 m; estimated investment cost: 257.808 €/2009 each) to the technical/economic life limit (dead year: see Table 1).

The total investment costs of the gradual substitution of older buses with 12 m CNG buses have been estimated 5.274.756 €/2008 and the relevant residual value in 2023 has been estimated 1.881.330 €/2008.

No other actions on the transport service have been implemented in this scenario (i.e.: ride number variations, different vehicle capacities, etc.) and therefore, the number of passenger (8.106.965 passengers/year) and the operating revenues (2.291.277 €/year) are the same in the time period considered for the scenario building.

The maintenance costs have been estimated considering the annual kilometrical values, referred to the different bus types used in this scenario (original buses and new 12 m CNG buses), as shown in detail in Table 4.

TABLE 4 – SCENARIO 0: kilometrical maintenance costs for each different vehicle ages

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bus City Class Diesel 12 m (€/Km)	0,0446	0,0894	0,1775	0,1485	0,1518	0,4931	0,3241	0,2346	0,2127	0,1670	0,6387	0,2482	0,2781	0,2322	0,6741
Bus City Class Methane 12 m (€/Km)	0,0277	0,0978	0,1560	0,2507	0,1696	0,2703	0,3772	0,4672	0,1664	0,1660	0,4883	0,2192	0,2347	0,2505	1,1448

Source: Brescia Mobilità

## Scenario 1 (Civitas measure)

The present Line 1 has been analysed considering only 18 m CNG buses running on the bus line itself (total vehicles: 16).

The whole investment cost in order to buy new CNG buses is 6.022.400 €/2009 (purchase year: 2009), equivalent to 5.886.999 €/2008, and the residual value of the substituted original buses has been estimated 1.881.330 €/2008.

The transport capacity and the ride frequency are changed in comparison to the 2008 service. The operating revenues increase, estimated during the first years, as shown in Table 5, basing on the real number of passenger recorded in 2010 (8.286.081 passengers/year).

TABLE 5 – Estimated operating revenues increase due to the new transport service

	2008	2009	2010	2011	2012	2013-2023
<b>Operating revenues (€2008)</b>	2.291.277	+1,0%	+1,0%	+0,5%	+0,5%	as 2012

The maintenance costs have been estimated considering the yearly kilometrical values, referred to different bus types used in this scenario: original buses in 2008 (see Table 4), substituted by 18 m CNG buses (see Table 6).

TABLE 6 – SCENARIO 1: kilometrical maintenance costs for each different vehicle ages

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
us Citelis Methane 18 m (€/Km)	0,0613	0,1231	0,1489	0,1664	0,1826	0,3213	0,3196	0,3376	0,1979	0,1912	0,4747	0,3721	0,2361	0,2723	0,3946

Source: Brescia Mobilità

The following tables (from 7 to 10) show the detailed CBA for each year of the time horizon considered (2008-2023).

**Life time cost and benefit**

Table 7 Capital cost in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2008	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2009	CIVITAS measure	€5,886,999
	Reference case (or BAU)	€527.476
Year 2010	CIVITAS measure	-
	Reference case (or BAU)	€1.318.689
Year 2011	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2012	CIVITAS measure	-
	Reference case (or BAU)	€1.054.951
Year 2013	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2014	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2015	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2016	CIVITAS measure	-
	Reference case (or BAU)	-

Measure title: **Measure Name**

City: **City Name**

Project: **Project name**

Measure number: **x.y**

	Cases for comparison	Cost
Year 2017	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2018	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2019	CIVITAS measure	-
	Reference case (or BAU)	€2.373.640
Year 2020	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2021	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2022	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2023	CIVITAS measure	-
	Reference case (or BAU)	-

Table 8 Maintenance cost in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2008	CIVITAS measure	€262,137
	Reference case (or BAU)	€262,137
Year 2009	CIVITAS measure	€56,504
	Reference case (or BAU)	€366,595
Year 2010	CIVITAS measure	€113,419
	Reference case (or BAU)	€282,152
Year 2011	CIVITAS measure	€137,259
	Reference case (or BAU)	€433,127
Year 2012	CIVITAS measure	€153,381
	Reference case (or BAU)	€164,523
Year 2013	CIVITAS measure	€168,316
	Reference case (or BAU)	€190,075
Year	CIVITAS measure	€296,129

Measure title:

**Measure Name**

City: **City Name**

Project: **Project name**

Measure number: **x.y**

	Cases for comparison	Cost
2014	Reference case (or BAU)	€384,981
Year 2015	CIVITAS measure	€294,506
	Reference case (or BAU)	€272,596
Year 2016	CIVITAS measure	€311,121
	Reference case (or BAU)	€301,122
Year 2017	CIVITAS measure	€182,389
	Reference case (or BAU)	€319,401
Year 2018	CIVITAS measure	€176,182
	Reference case (or BAU)	€806,728
Year 2019	CIVITAS measure	€437,442
	Reference case (or BAU)	€181,109
Year 2020	CIVITAS measure	€342,873
	Reference case (or BAU)	€219,804
Year 2021	CIVITAS measure	€217,557
	Reference case (or BAU)	€194,743
Year 2022	CIVITAS measure	€250,972
	Reference case (or BAU)	€311,613
Year 2023	CIVITAS measure	€363,618
	Reference case (or BAU)	€306,681

Table 9 Operating revenues in the evaluation period (not discounted)

	Cases for comparison	Values
Year 2008	CIVITAS measure	€2,291,277
	Reference case (or BAU)	€2,291,277
Year 2009	CIVITAS measure	€2,314,190
	Reference case (or BAU)	€2,291,277
Year 2010	CIVITAS measure	€2,337,332
	Reference case (or BAU)	€2,291,277
Year 2011	CIVITAS measure	€2,349,018
	Reference case (or BAU)	€2,291,277

Measure title: **Measure Name**

City: **City Name**

Project: **Project name**

Measure number: **x.y**

	Cases for comparison	Values
Year 2012	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2013	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2014	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2015	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2016	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2017	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2018	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2019	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2020	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2021	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2022	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277
Year 2023	CIVITAS measure	€2,360,763
	Reference case (or BAU)	€2,291,277

Table 10 Environmental emissions (not discounted)

	Cases for comparison	Values
Year 2008	CIVITAS measure	€379,625
	Reference case (or BAU)	€379,625
Year	CIVITAS measure	€12,303

Measure title: **Measure Name**

City: **City Name**

Project: **Project name**

Measure number: **x.y**

	Cases for comparison	Values
2009	Reference case (or BAU)	€348,795
Year 2010	CIVITAS measure	€12,303
	Reference case (or BAU)	€110,580
Year 2011	CIVITAS measure	€12,303
	Reference case (or BAU)	€110,580
Year 2012	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2013	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2014	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2015	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2016	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2017	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2018	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2019	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2020	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2021	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2022	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026
Year 2023	CIVITAS measure	€12,303
	Reference case (or BAU)	€19,026

**Summary of CBA results**

The CBA has been carried out on comparing the scenario 0 (Reference case or BaU) and 1(Civitas measure) described above.

The CBA synthetical results are shown in the tables 11 and 12 reported below. All figures are referred to Euro 2008. The average yearly interest rate estimated in the CBA is 3,5%.

TABLE 11 – CBA synthetical results between Scenario 1 (Civitas measure) and Scenario 0 (Reference case or BaU) in year 2023.

<b>SCENARIO 1 vs SCENARIO 0</b>	
INTEREST RATE	3,5%
NET PRESENT VALUE (€ 2008)	1.602.360
BENEFITS/COSTS RATIO	1,28
I.R.R.	21,3%

In particular, the purchase of buses described in the Civitas scenario (Scenario 1) is re-paid in approx. 4 years (NPV>0 at 2012), due to the Line 1 better transport supply and to the lower maintenance and emission costs in comparison to scenario 0 (which keeps unchanged the fleet operating in 2008 and foresees the gradual substitution of the older buses with 12 m CNG ones).

Measure title: **Measure Name**

City: **City Name**

Project: **Project name**

Measure number: **x.y**

TABLE 12 - CBA full results between Scenario 1 (Civitas measure) and Scenario 0 (Reference case or BaU) from 2008 to 2023

**MEASURE M01.06 - CLEAN AND ENERGY EFFICIENT PUBLIC TRANSPORT FLEET IN BRESCIA**  
**COSTS/BENEFITS ANALYSIS - Scenario 1 vs Scenario 0**

	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
<b>SCENARIO 0 - With n.20 existing busses (methane+diesel; 12m) and fleet renewal with n.20 methane busses of 12m length (average bus life: 15 years)</b>																
Investment costs	-	527.476	1.318.689	-	1.054.951	-	-	-	-	-	-	2.373.640	-	-	-	-
Residual value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1.881.330
Operating revenues	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277	2.291.277
Maintenance costs	262.137	366.595	282.152	433.127	164.523	190.075	384.981	272.596	301.122	319.401	806.728	181.109	219.804	194.734	311.613	306.681
Emissions	379.625	348.795	110.580	110.580	19.026	19.026	19.026	19.026	19.026	19.026	19.026	19.026	19.026	19.026	19.026	19.026
<b>SCENARIO 1 - With n.16 new methane busses (18 m; average bus life: 15 years)</b>																
Investment costs	-	5.886.999	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Residual value	-	1.881.330	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operating revenues	2.291.277	2.314.190	2.337.332	2.349.018	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763	2.360.763
Maintenance costs	262.137	56.504	113.419	137.259	153.381	168.316	296.129	294.506	311.121	182.389	176.182	437.442	342.873	217.557	250.972	363.618
Emissions	379.625	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303	12.303
<b>SCENARIO 1 vs SCENARIO 0</b>																
Investment costs	-	5.359.523	1.318.689	-	1.054.951	-	-	-	-	-	-	2.373.640	-	-	-	-
Residual value	-	1.881.330	-	-	-	-	-	-	-	-	-	-	-	-	-	1.881.330
Operating revenues	-	22.913	46.055	57.741	69.486	69.486	69.486	69.486	69.486	69.486	69.486	69.486	69.486	69.486	69.486	69.486
Maintenance costs	-	310.091	168.733	295.869	11.142	21.759	88.853	21.910	9.999	137.013	630.545	256.334	123.068	22.823	60.641	56.937
Emissions	-	336.492	98.278	98.278	6.723	6.723	6.723	6.723	6.723	6.723	6.723	6.723	6.723	6.723	6.723	6.723
TOTAL	-	2.808.697	1.631.755	451.888	1.142.303	97.969	165.063	54.300	66.211	213.223	706.755	2.193.517	46.859	53.386	136.851	1.862.056
OVERALL TOTAL	-	2.808.697	1.176.943	725.055	417.248	515.216	680.279	734.580	800.790	1.014.013	1.720.768	3.914.285	3.867.426	3.920.812	4.057.663	2.195.607
TOTAL BENEFIT	-	2.550.826	1.631.755	451.888	1.142.303	97.969	165.063	76.210	76.210	213.223	706.755	2.449.850	76.210	76.210	136.851	76.210
TOTAL COST	-	5.359.523	-	-	-	-	-	21.910	9.999	-	-	256.334	123.068	22.823	-	1.938.266
<b>INTEREST RATE</b>																
	3,5%															
NET PRESENT VALUE	-	2.621.949	1.150.200	756.406	205.383	285.080	414.818	456.054	504.635	655.793	1.139.881	2.591.514	2.561.552	2.594.534	2.676.219	1.602.360
BENEFITS/COSTS RATIO		0,48	0,78	0,86	1,08	1,10	1,13	1,14	1,15	1,19	1,32	1,69	1,67	1,68	1,70	1,28
I.R.R.				-21,4%	7,9%	9,4%	11,5%	12,1%	12,7%	14,2%	17,5%	22,9%	22,8%	22,9%	23,0%	21,3%

*Measure title:* **RENEWABLE ENERGY PRODUCTION TO FEED BUSES WITH LOW ENVIRONMENTAL IMPACT**

*City:* **Brescia**

*Project:* **MODERN**

*Measure number:* **01.11**

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## **M01.11 – Executive summary**

The measure belongs to the thematic area “alternative fuels” and it regards the production of energy through the enlargement of the existing Brescia Trasporti (Public Transport Company in Brescia) photovoltaic system, in order reach independence at an energetic level and recharging the batteries of hybrid busses (Hybrid busses are a part of Brescia Trasporti fleet).

The objective of the measure consisted in the energy production and in the emissions reduction. It’s important to highlight that this action strictly belongs to Brescia Trasporti policy.

During the first year of measure implementation of the new photovoltaic system, the energy production was doubled. To obtain such result it was necessary to design the system, obtain its approval by the Municipality, purchase and install it alongside to the existing one.

In order to evaluate the objective achievement, a set of indicators was measured to monitor the objective achievements and to check the emission levels, and operating costs.

The new plant characterised by a peak power of 76,8 KWp was built in the period between January and March 2011, and started its operation in April 2011. During the first year (May 2011-Apr.2012) the new system produced 97.736 kWh. This production is almost twice in respect to the previous power plant. Furthermore, in the first year, the new system entailed the reduction of 52 Ton of CO2 and the saving of 22 TOE.

From the impact point of view the measure is considered of success, while by considering the process evaluation aspects it needs to be pointed out the following:

- it is easier to implement such kind of measure if funding is available;
  - if the funding is limited within a time period it may be possible to have a shortage of technical devices, due to a general rush.
-

*Measure title:* **RENEWABLE ENERGY PRODUCTION TO FEED BUSES WITH LOW ENVIRONMENTAL IMPACT**

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## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(D) High level / longer term:

- To improve the environment quality by the use of alternative fuels and of clean and energy efficient vehicles

(E) Strategic level:

- To produce renewable energy with photovoltaic system to feed busses, in accordance with the policy of Brescia Trasporti and more generally with the objectives of the city based on sustainable development. The production of renewable energy can obtain a reduction of CO2 emission in atmosphere and energy saving in terms of TOE (The lifetime of the photovoltaic is about 25 year; during these years it will produce 1.400 MWh with an energy saving of 120 Toe and a reduction of emission into the atmosphere of 905 tons of CO2).

(F) Measure level:

- Extension of the existing photovoltaic plant to reach the capacity of 100 KWp in order to:
  - (1). To recharge batteries of all hybrid busses (existing + new ones) within the available fleet by using energy from a new photovoltaic system that will be integrated to the already existing one.
  - (2). To decrease by 7% the electricity demand in the range of peak with a reduction of 10% of currently incurred costs .
  - (3). To produce (\*): 188 MWh (about 144 MWh/year)
  - (4). To reduce CO2 (\*): 100 tCO2 (about 50 tCO2/year)
  - (5). To save energy (\*): 38 TOE (about 19 TOE/year)

### **A2 Description**

Brescia Trasporti has always cared about environmental and mobility needs. The company has continuously promoted the use of alternative fuels and of clean and energy efficient vehicles (NCG and hybrid busses), in order to reduce pollution, exhaust gases and noise. Additionally, it has sought independence at an energetic level installing a photovoltaic plant.

*Measure title:* **RENEWABLE ENERGY PRODUCTION TO FEED BUSES WITH LOW ENVIRONMENTAL IMPACT**

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The increased consumption of natural gas, by the Brescia Trasporti fleet, increased the level of electricity consumption due to the need of compressing it into the gas tanks. The amount of electricity consumption for compressing the natural gas is about 40% of total consumed energy.

Besides the consumption of electricity used to compress methane, energy is used also to charge the electric buses batteries. Brescia Trasporti has in its fleet four hybrid-electric busses with gas turbine (Horus). These buses reduce levels of noise to very low and also polluting emissions

In 2003 Brescia Trasporti was awarded the “friend of environment” prize thanks to the use of these busses,

The energy produced (46.633Kwh/year, in 2009) by the existing photovoltaic system (built on the bus depot roof, in 2008 ) was sufficient to feed hybrid busses, which were part of the BST fleet.

Brescia Trasporti decided to extend the existing photovoltaic system to reach a capacity of 100 KWp thanks to:

- the availability of space on the roof,
- the new technologies on the performance of the photovoltaic modules,
- the preparation of the existing system for further expansion,

Such energy was needed to feed new hybrid busses within the fleet of Brescia Trasporti - methane and electric propulsion - (in Measure 01.06 “Clean and energy efficient public transport fleet in Brescia” 4 hybrid methane and electric propulsion buses were bought.).

Because the tender for the new photovoltaic plant showed that since 2008 the price of modules had decreased significantly and the available budget was more than enough, Brescia Trasporti decided to increase the peak power up to 76,8 KWp instead of 50 KWp.

The system now has got an annual average production of 150.000 kWh/year, which corresponds to 28 toe (saved petroleum equivalent ton) and to a reduction of the emission in the atmosphere of 80 ton CO<sub>2</sub> every year. In particular, the contribution brought by the new section of the plant (installed thanks to the Civitas initiative) consists of approximately 75000 kWh produced, 14 toe saved and 40 ton CO<sub>2</sub> reduced every year.

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## **B. Measure implementation**

### **B1 Innovative aspects**

The innovative aspects of the measure are:

**New physical infrastructure solutions** – As Brescia Trasporti fleet was equipped with four new innovative hybrid busses (natural gas + electrical propulsion). After benchmarking activities. The upgrade of the existing photovoltaic system was performed installing a 76,8kw photovoltaic system.

It has the following configuration:

- n. 4 inverter “Refusol” 17K (Fig. 1)
- 384 photovoltaic modules “Heckert Solar PXL 200” (Fig. 2)



Fig. 1 Inverter "Refusol" 17K

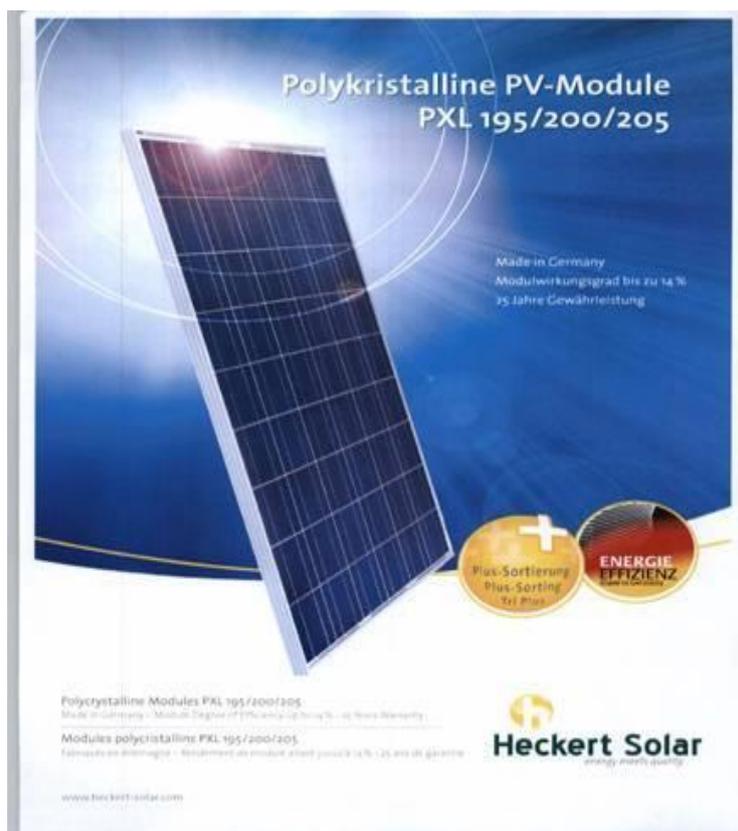


Fig. 2 Photovoltaic Modules Heckert Solar PXL 200

## B2 Research and Technology Development

The research activity of Brescia Trasporti consisted in the evaluation of the photovoltaic system installed in 2008, in order to improve the design of the new system.

Production data, radiation, position and performance were analyzed. In July 2010 Brescia Trasporti completed the draft of the new plant: the layout of the new photovoltaic system was designed in relation to:

- the available space on the roof;
- the exposure to the sun on the roof;
- the shadow caused by the chimneys and the skylights existing on the roof;
- the space required for operator access and movement for maintenance .

Brescia Trasporti in agreement with Brescia Municipality defined the technical features for the supply modules and inverter for an installation of 50 kW and sent them to supply companies.

In 2009 the inverter devices were sold out and were no longer available (as the new decree “Conto Energia” on funding for energy production from photovoltaic system penalized the systems installed after January 1<sup>st</sup> 2011, everybody tried to install them in 2010). The inverter devices were available again at the beginning of 2011.

Most of the offers received in 2009 were not complete. The technical-economic analysis and evaluation of offers received showed that the best configuration, in terms of performance, inverter-panels was presented by the company “Fotosintesi”.

After the economical offers analysis in which it was evident that the price of panels had decreased Brescia Trasporti decided to install a 76,8 kW photovoltaic system.

### **B3 Situation before CIVITAS**

Brescia Trasporti decided to be more independent in energy production through the installation of a photovoltaic plant. In 2008 Brescia Trasporti set up a first photovoltaic system of 50 KWp. The system was built covering 423 m<sup>2</sup> of the bus depot roof.

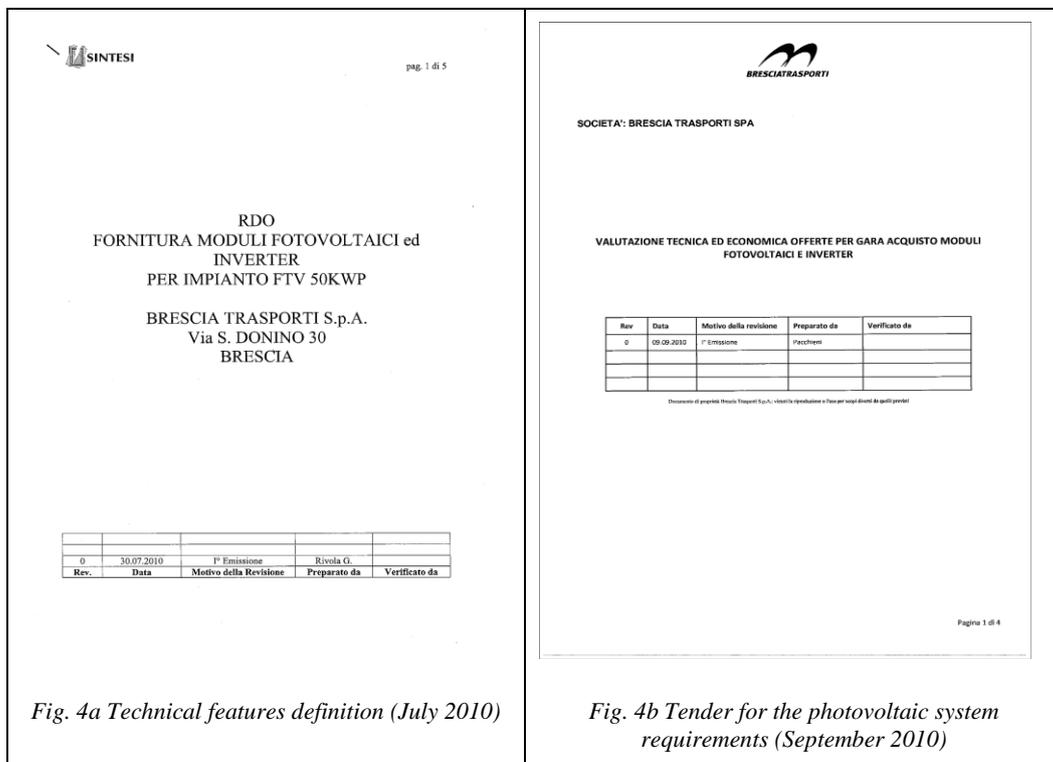
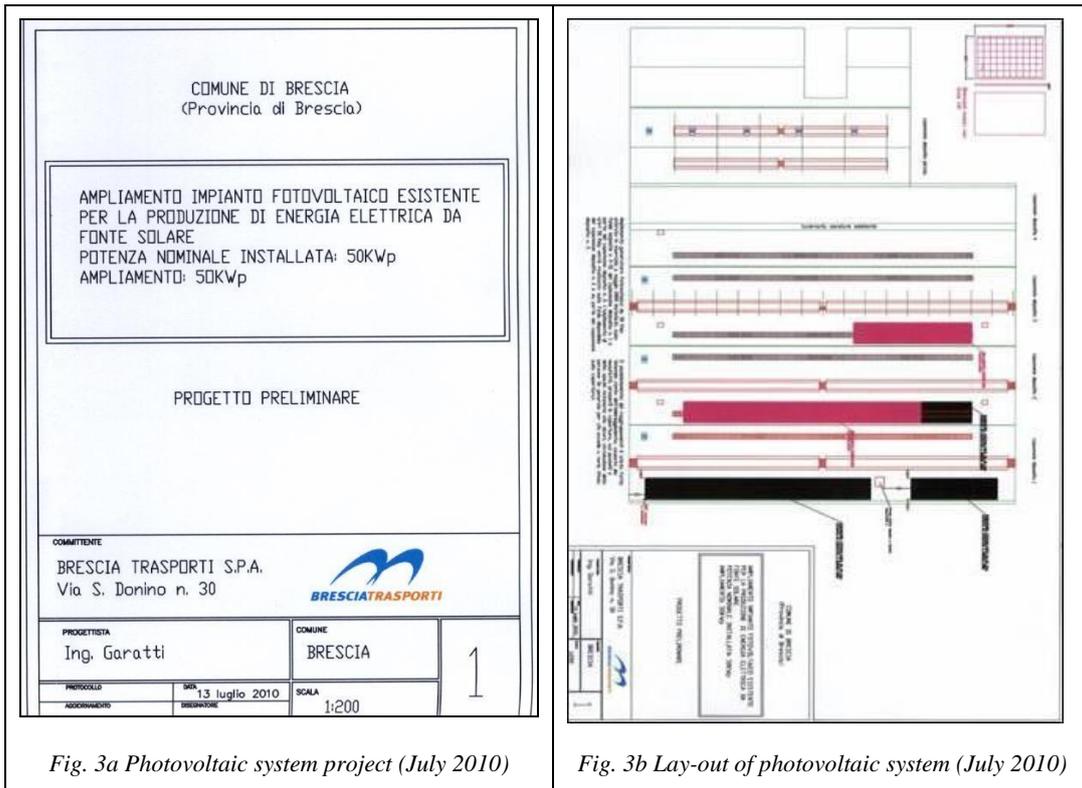
The photovoltaic system has the following characteristic: 252 polycrystalline silicon modules (195 W each), installed in parallel to the surface of the roof. The system, operating from 1<sup>st</sup> May 2008, in about two years produced 39.000 kWh.

The existing system didn't allow to increase the number of hybrid buses remaining independent from an energetic point of view.

### **B4 Actual implementation of the measure**

The measure was developed as explained below, according to the following stages:

**Stage 1: Executive design of the photovoltaic system** (*March 2010 – December 2010*) – *The first step consisted in research activities to define the executive design of the photovoltaic system according to the safety and innovativeness of the system. In particular Brescia Trasporti aimed at reaching a total capacity over 100KWp (from the total system composed by the existing and the new photovoltaic panels), in order to produce enough energy to feed the busses and to compress the natural gas for the hybrid bus tanks. Particular attention was given to the aspects related to maintenance and operation procedures. This stage included also the project (Fig. 3a, 3b), the authorization, the tender (Fig. 4a, 4b), the devices purchase procedures.*



**Stage 2: Installation of the new photovoltaic system, training of the operators and experimental phase** (December 2010 – March 2011) – *After the technical components purchase, the next stoe consisted in the installation of the panels and of the inverter (Fig. 5, 6), in order to start the test phase, according to the laws.. Only after the system testing and its calibration Brescia Trasporti received the license for the connection of the plant to the public network.*



*Fig. 5 Brescia Trasporti – The existing photovoltaic system installed in 2008*



*Fig. 6 Installation of the new photovoltaic system 76,8 kWp*

**Stage 3: kick off of the service** (April 2011 – October 2012) – *On 28<sup>th</sup> April 2011 the new system (Fig. 7) was put into service. In June 2011 the plant already produced 28.720 kWh and the specific energy*

*production of the new plant was higher than the old one (141,93 kWh/kWp instead of 128,55 kWh/kwp). In December 2011 the plant produced 128.000 kWh.*



*Fig. 7 Inverter and panel of the new photovoltaic system 76,8 KWp*

## **B5 Inter-relationships with other measures**

This measure is not related to others in terms of measure output, but it can be considered related to the other Brescia Trasporti SpA measures in terms of high level objectives “to improve the environment quality by the use of alternative fuels and of clean and energy efficient vehicles”

In particular, the measure is related to Measure 1 no. M01.06 – Clean and energy efficient public transport fleet in Brescia.

## C. Evaluation – methodology and results

The implementation of the measure mainly consists in producing renewable energy with photovoltaic system to feed busses. The indicators selection aimed at measuring the measure outputs - to recharge batteries of all hybrid busses and to decrease by 7% the electricity demand in the range of peak with a reduction of 10% of currently incurred costs.

Only few indicators have been selected to have information about the strategic level (i.e. considering the fleet composition on the whole).

### C1 Measurement methodology

The indicators have been divided into two macro-categories: main indicators and complementary indicators.

Main indicators are able to evaluate the measure efficiency in terms of objectives achievement. In addition complementary indicators were introduced in order to assess specific issues. These indicators are used to give additional information in order to better understand the measure performance.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators**

No.	Impact	Indicator	Data used	Comments
1	Economy	Average Operating Revenues	Data coming from the energy plant (energy produced) per month.	Main Indicator
2	Energy	Fuel mix	Data coming from BST (Fleet composition, mileage and fuel consumption).	Main Indicator
3	Energy	Energy consumption for hybrid bus/tot fuel produced by solar plan	Data coming from BST (energy consumption by electric busses and energy produced by solar plant).	Main Indicator
4	Environment	CO emissions	COPERT methodology	Complementary indicator Referred to the fleet
5	Environment	NOx emissions	COPERT methodology	Complementary indicator Referred to the fleet
6	Environment	Small particulate emissions	COPERT methodology	Complementary indicator Referred to the fleet
7	Environment	CO2 emission avoided	Data coming from the energy plant (energy produced)	Main Indicator

No.	Impact	Indicator	Data used	Comments
8	Environment	% Km Hybrid bus	Data coming from BST (Fleet composition, mileage)	Main Indicator

Detailed description of the indicator methodologies:

**Indicator 1 (Average Operating Revenues)** – Revenues come from the national funding for every kWh produced by the plant (0,40 €/kWh = “conto energia” fare for the existing plant as stated in the Decree 19 July 2007) and from the savings on the bills (0,11 €/kWh), net of tax deductions and of excises. Data referred to energy production (kWh) are monthly collected by an electricity meter placed downstream of the photovoltaic plant. In particular, the methodology for the calculation of the indicator, provided for each month is the following:

**AVERAGE OPERATING COSTS** = (NET REVENUES FROM “CONTO ENERGIA” + REVENUES FROM BILL SAVINGS) – EXCISE UTF

where:

NET REVENUES FROM “CONTO ENERGIA” = (Produced Energy \* “conto energia” fare) – Tax deduction 4%

REVENUES FROM BILL SAVINGS = Produced Energy \* Energy cost VAT excluded 0,1%

EXCISE UTF is a variable value

Details on the indicator calculation methodology is reported in Annex A2 section.

**Indicator 2 (Fuel mix)** – This indicator is expressed by the ratio between the energy consumed by a kind of vehicle (Gasoil, Methane gas and Hybrid powered vehicles) and the total energy consumed by the fleet. The Energy consumption depends on the total mileage and on the consumption factors.

Details on the indicator calculation methodology is reported in Annex A2 section.

**Indicator 3 (Energy consumption for hybrid bus/tot fuel produced by solar plan)** –

The Energy consumption for hybrid busses (Electric-Methane gas) depends on the “electric km” travelled by hybrid busses. The total mileage is therefore divided into km travelled using methane gas (70%) and the ones travelled using Electric Energy (30%). This last value is multiplied by an average consumption factor (1,25 kWh/km). In order to calculate the indicator, that value has been divided by the total energy produced by the photovoltaic plant.

Details on the indicator calculation methodology is reported in Annex A2 section.

**Indicator 4 (CO emissions)** – Emissions are calculated following the COPERT methodology, multiplying the mileage [km] of the fleet described in M01.06 and a specific emission factor [g/km]. Emission factors vary on the fleet, that has been classified by kind of fuel and EURO label .

Details on the indicator calculation methodology and on the fleet composition are reported in Annex A2 section.

**Indicator 5 (NOx emissions)** – Emissions are calculated following the COPERT methodology, multiplying the mileage [km] of the fleet described in M01.06 and a specific emission factor [g/km]. Emission factors vary on the fleet, that has been classified by kind of fuel and EURO label.

Details on the indicator calculation methodology and on the fleet composition are reported in Annex A2 section.

**Indicator 6 (Small particulate emissions)** – Emissions are calculated following the COPERT methodology, multiplying the mileage [km] of the fleet described in M01.06 and a specific emission factor [g/km]. Emission factors vary on the fleet, that has been classified by kind of fuel and EURO label.

Details on the indicator calculation methodology and on the fleet composition are reported in Annex A2 section.

**Indicator 7 (CO2 emission avoided)** - This indicator is calculated considering the CO2 emission avoided using Energy coming from the photovoltaic plant, instead of using energy coming from conventional sources. To produce 1 electric kWh, the equivalent amount of 2,56 kWh under the shape of fossil fuel is burned and about 0,531 kg of CO2 is produced (emission factor of the Italian electric mix referred to the distribution).

**Indicator 8 (% Km Hybrid bus)** - This indicator is given by the ratio between the mileage travelled by the hybrid fleet and the total fleet mileage described in the M01.06.

## C1.2 Establishing a Baseline

It's important to stress that the main objective of the plant extension is to reduce the costs for the energy purchase and to increase the use of renewable energy (and, as a consequence, to reduce the CO<sub>2</sub> emissions in atmosphere). Another practical goal is to recharge the batteries of all the hybrid buses (which at the moment represent a small part of the fleet) using the photovoltaic system.

Indicator 1 (Average Operating Revenues) and 7 (CO<sub>2</sub> emission avoided) are related to the photovoltaic plant and depend on the energy produced by the plant; indicator 3 (Energy consumption for hybrid bus/tot fuel produced by solar plan) and 8 (% Km Hybrid bus) are specifically related to the hybrid buses and indicators 2 (Fuel mix), 4 (CO emissions), 5 (NOx emissions), 6 (Small particulate emissions) are related to the whole fleet and depend on the km travelled by the fleet.

The baseline is assumed in year 2009, before the OP of the measure (which is April 2011, when the extension of the photovoltaic plant was put into operation).

In particular, Indicator n.1 is calculated referring to the operational year of the plant , therefore its baseline is referred to the period that goes from May 2008 to Apr 2009. All the other indicators are referred instead to the solar year, going from January to December.

Photovoltaic Plant	BASELINE 2009
1) Average Operating Revenues	21.710 € (May 2008 – Apr 2009)
7) CO <sub>2</sub> emission avoided	24.762 kg/year

**Table 3 – Baseline for the indicators related to the Photovoltaic Plant**

Hybrid buses	BASELINE 2009
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3) Energy consumption for hybrid bus/tot fuel produced by solar plan	80,34%
8) % Km Hybrid bus	1,21%

**Table 2 – Baseline for the indicators related to the Hybrid buses**

Whole fleet	BASELINE 2009
2) Fuel mix	1,01% of the fuel is consumed by Hybrid busses (Methane gas + Electricity)
4) CO emissions	9.022 kg CO/year
5) NOx emissions	46.407 kg NOx/year
6) Small particulate emissions	480 kg SP/year

**Table 3 – Baseline for the indicators related to the Whole fleet**

### C1.3 Building the Business-as-Usual scenario

The existing plant was put into operation on May 2008 and has been running at top speed since 2009. Without CIVITAS contribution the extension of the plant wouldn't have taken place therefore indicators related to the clean energy production can be considered constant.

In relation to the fleet it must be underlined that only hybrid buses are conditioned by the energy produced by the plant and Brescia Trasporti had already decided to purchase two new hybrid busses therefore we can make the same assumption already made for measure 01.06 "Clean and energy efficient public transport fleet in Brescia", namely:

- the bus urban network was substantially modified in 2004, when it was extended to the suburban area of Brescia. Therefore, since 2004 the total number of km travelled by the whole fleet can be considered constant, because the fleet itineraries, frequency or capacity didn't vary considerably;
- the km covered by each kind of vehicle has been set constant;
- the fleet composition has been estimated in 2012, keeping the same kind of vehicles of the baseline situation but varying the number of vehicles. This hypothesis is especially valid in the case of the hybrid busses, which in the BaU scenario cover the same amount of km of the baseline situation. It's possible to assume that the on demand transport service (served by that kind of vehicles) without the Civitas contribution in 2012 wouldn't have experienced any significant change in terms of mileage.

As a consequence of the methodological assumptions mentioned above, in the BaU scenario, the BaU values of the indicators n.1 (Average Operating Revenues) and n.7 (CO<sub>2</sub> emission avoided), which both depend on the energy produced by the plant, equal the baseline ones. In particular, Indicator. 1 has been calculated projecting the historical data series (because the monthly operating revenues are available since may 2008).

Photovoltaic Plant	BaU 2012
1) Average Operating Revenues	23'885,46 €
7) CO <sub>2</sub> emission avoided	24'762 kg/year

**Table 4 – BaU for the indicators related to the Photovoltaic Plant**

The BaU scenario for the indicators n.3 (Energy consumption of the hybrid busses/tot energy produced by solar plant) and n.8 (% km Hybrid busses) has been built taking into account the purchase of 2 new hybrid busses. As the energy consumed by the hybrid fleet depends on the km covered by the fleet itself (which has been set constant in time), the BaU values of these two indicators equal the baseline ones.

<b>Hybrid busses</b>	<b>BaU 2012</b>
3) Energy consumption for hybrid bus/tot fuel produced by solar plan	80,34 %
8) % Km Hybrid bus	1,21 %

**Table 5 – BaU for the indicators related to the Hybrid busses**

The BaU scenario of the indicators related to the whole fleet depends on the mileage covered by each kind of vehicle composing the fleet (which has been considered constant, according to the assumptions described above), therefore, the fuel mix (Indicator. 2) and the emissions estimation (indicators n.4 “CO emissions”, n.5 “NOx emissions” and n.6 “Small particulate emissions”) equal the baseline values.

<b>Whole fleet</b>	<b>BaU 2012</b>
2) Fuel mix	1,01% of the fuel is consumed by Hybrid busses (Methane gas + Electricity)
4) CO emissions (kg/year)	9.022 kg CO/year
5) NOx emissions (kg/year)	46.407 kg NOx/year
6) Small Particulate emissions (kg/year)	480 kg SP/year

**Table 6 – BaU for the indicators related to the Whole fleet**

## C2 Measure results

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

This measure is not related to others in terms of measure output.

### C2.1 Economy

**Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”**

Indicator	Before (May. 2008-Apr. 2009)	After (May 2011 - April 2012)	B-a-U (May 2011 - April 2012)	Difference: After –Before	Difference: After – B-a-U
1. Average Operating Revenues	21.710,00 €;	76.883,00 €	21.887,70 €	+ 55.173,00€	+54.995,30 €

Indicator n. 1 (Average Operating Revenues), makes evident that installing a photovoltaic plant using the national funding leads to revenues growth (in this case of +210%).

### C2.2 Energy

**Table C2.2.1: Measure results for the indicators of the category “Energy”**

Indicator	Before (year 2009)	After (year 2011)	B-a-U (2011=2012) (*)	Difference: After –Before	Difference: After – B-a-U
2. Fuel mix	1,01% of the fuel is consumed by Hybrid busses (Methane gas + Electric)	(year 2011) 1,03% of the fuel is consumed by Hybrid busses (Methane gas + Electric)	1,01% of the fuel is consumed by Hybrid busses (Methane gas + Electricity)	+ 0,02 %	+ 0,02 %
3. Energy consumption for hybrid bus/tot fuel produced by solar plant	80,34 %	29,75%	80,34 %	-50,59%	-50,59%

**(\*) The BaU scenario in 2012 is the same as the one in 2011 as the methodological assumptions taken for the building of the two scenarios didn't change. For more details see the section "C.1.3 Building the Business-as-Usual scenario".**

Indicator n.2 (fuel mix) expresses the fuel consumption of the hybrid vehicles respect to the total fuel consumed by the fleet.

As the km covered by the hybrid busses didn't substantially vary in time (99.911 km in 2009; 101.300 km in 2011), the fuel consumption keeps a stable trend.

As regards indicator n. 3 (Energy consumption for hybrid bus/tot fuel produced by solar plant), the extension of the photovoltaic plant allowed the use of a lower part of the energy produced by the plant for the hybrid busses battery power supply considering, at the same time, the increasing of the hybrid fleet from 4 to six buses.

### C2.3 Environment

**Table C2.3.1: Measure results for the indicators of the category "Environment"**

Indicator	Before (2009)	After (2011)	B-a-U (2011=2012) (*)	Difference: After –Before	Difference: After – B-a-U
4. CO emissions	9.022 kg/year	8.262 kg/year	9.022 kg/year	- 760 kg/year	- 760 kg/year
5. NOx emissions	46.407 kg/year	42.476 kg/year	46.407 kg/year	- 3.931 kg/year	- 3.931 kg/year
6. Small particulate emissions	480 kg/year	211 kg/year	480 kg/year	-269 kg/year	-269 kg/year
7. CO2 emissions avoided	24.762 kg/year	67.807 kg/year	24.762 kg/year	+ 43.045 kg/year	+ 43.045 kg/year
8. % Km Hybrid bus	1,21%	1,25%	1,21%	+ 0,04 %	+ 0,04 %

**(\*) The BaU scenario in 2012 is the same as the one in 2011 as the methodological assumptions taken for the building of the two scenarios didn't change. For more details see the section "C.1.3 Building the Business-as-Usual scenario".**

As regards the indicators concerning the pollutant gas emissions of the fleet (indicators n. 4, 5, 6 and 7, expressed in kg/year) a general decrease is observed in the after situation.

In particular, the small particulate emissions register the most significant decrease, while the CO<sub>2</sub> avoided emissions is more than doubled.

The km covered by the hybrid busses (expressed by the indicator n. 8) register a stable trend, because, even if two new hybrid busses were purchased, the mileage covered increased less than 1%. as the

hybrid buses are mainly used for “On demand” service for disabled people and for “Bussola” service (the latter remains within the historical centre).

The final consideration about the results obtained through the calculation of the selected indicators is that the objectives set by this measure have been widely achieved.

### Summary of the main CBA results (for more details see Annex 3)

The CBA was carried out comparing the two scenarios: Scenario 0 (any PV extension purchase of two new CNG 8m long buses and their substitution after 15 years, i.e. at the end of the technical life) and Scenario 1 (implemented thanks to the Civitas initiative, i.e extension of the PV plant and purchase of 2 hybrid methane-electric 8m long buses).

From the observation of the CBA results, it’s possible to say that the purchase of n.2 hybrid buses and of the additional photovoltaic system (Scenario 1) is paid back in approx. 12 years (NPV>0 at 2022), likely thanks to:

- the use of a part photovoltaic energy to feed the new hybrid busses;
- the sale of the remaining third of photovoltaic energy (surplus);
- the lower maintenance and emission costs in scenario 1 (Civitas measure) respect to Scenario 0 (Business-as-Usual)

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>Recharge batteries of all hybrid busses within the available fleet by using energy from the new photovoltaic system that will be integrated to the already existing one</p> <p><b>Indicator. 3</b> <i>Energy consumption for hybrid buses/total fuel produced by solar plant</i></p> <p><i>Before (year 2009) = 80,34%</i></p> <p><i>After (year 2011) = 29,75 %</i></p> <p><i>The energy required for the hybrid buses batteries recharge, in relation to the present fleet, was already entirely covered by the existing photovoltaic plant before Civitas.</i></p> <p><i>The objective can be anyway considered more than achieved because the extension of the photovoltaic plant, besides covering the energetic cost of the current fleet, will be able to support a fleet composed by a higher number of hybrids vehicles (of those were purchased in 2011). This eventuality is given by the transport company will to extend the 8m hybrid buses fleet for a new On demand transport service addressed to the low density residential areas.</i></p>	***
2	<p>Decrease of 7% of electricity demand in the range of peak with a reduction of 10% of cost currently incurred</p> <p><i>This objective can be expressed in terms of “Average Operating Revenues” (Indicator. 1) instead of “currently incurred costs”.</i></p> <p><i>Before (year May 2008 – Apr 2009) = 21.710,00 €</i></p> <p><i>After (year May 2011 – Apr 2012) = 76.883,00€</i></p>	***

No.	Target	Rating
	<p><i>The objective is Exceeded.</i></p> <p><i>The extension of the photovoltaic plant will allow to increase the revenues and, as a consequence, to decrease the energy costs of the company.</i></p>	
3	<p>Produce 144 Mwh/year (during Civitas: 138 Mwh)</p> <p><i>The achievement can be evaluate considering the energy monthly produced.</i></p> <p><i>From <b>indicator n. 1</b> it's possible to extract the amount of energy monthly produced by the plant.</i></p> <p><i>Before (year May 2008 – Apr 2009) = 46.243 MWh</i></p> <p><i>After (year May 2011 – Apr 2012) = 165.178 MWh</i></p> <p><i>As the plant as good as doubled after its extension, it's possible to assess that also the energy production is more than doubled, therefore this objective can be considered exceeded.</i></p>	***
4	<p>Reduce CO2: 50 tCO2/year (during Civitas: 100 tCO2)</p> <p><i><b>Indicator n. 7</b> "CO2 avoided" is able to express the achievement of this objective. As the plant as good as doubled after its extension, it's possible to assess that also tha amount of CO2 avoided doubled, therefore this objective can be considered exceeded..</i></p> <p><i>Before (year 2009) = 24.762 kg/year</i></p> <p><i>After (year 2011) = 67.807 kg/year</i></p>	**
5	<p>Save energy: 19 TOE/year (during Civitas: 38 TOE)</p> <p><i>The network energy savings thanks to the production of energy from a photovoltaic plant is estimated in 0,23 TOE every MWh produced.</i></p> <p><i>From <b>indicator n. 1</b> it's possible to extract the amount of energy produced by the plant, therefore the calculation of the energy saving is made multiplying that value by 0,23:</i></p> <p><i>Before (year May 2008 – Apr 2009) = 0,23 TOE/MWh * 46,.243 MWh = 10,635 TOE</i></p> <p><i>After (year May 2011 – Apr 2012) = 0,23 TOE/MWh * 165,178 MWh = 37,99 TOE</i></p> <p><i>As the plant as good as doubled after its extension, it's possible to assess that also the energy production increases, therefore this objective can be considered achieved in full.</i></p>	***
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full            *** = Exceeded</b></p>		

## C4 Up-scaling of results

No up-scaling is possible at the moment as the available part of the roof has already been covered by photovoltaic elements. Whenever there will be a part of roof available the up-scaling will be possible with economic and energetic benefits proportional to the up-scaling itself.

## C5 Appraisal of evaluation approach

The evaluation approach firstly considered project's objectives as expressed explicitly in the original evaluation plan. The data collection methodology and the data quality are sufficient for the needs of technical evaluation of the measure.

The indicators were selected at the beginning of Civitas project and the chosen ones belong to the following categories: Economy, Energy and Environment. The ex ante and ex post data collections were carried out as defined in the original plan.

Indicators n.2. "Fuel mix" n.3. "Energy consumption for hybrid bus/tot fuel produced by solar plant" and n. 8 "% Km Hybrid bus" evaluated the impact of the measure in relation to the Hybrid fleet, even if the number of the hybrid vehicles compared to all the BST fleet is small (6 vehicles per 203 vehicles in 2011, equal to 3%),

Indicators n. 4 "CO emissions", n. 5 "NOx emissions", n. 6 "Small particulate emissions", n.7 "CO2 emissions avoided" evaluated the results in relation to emission reduction that could be useful whenever a choice related to the possibility of creating a roof available for the photovoltaic panels is taken into consideration (i.e up-scaling action, more details in section C.1.1). Also Indicator n. 1 "Average operating revenues" is useful for the same reason.

## C6 Summary of evaluation results

The key results are as follows:

- **Key result 1 – energy production:** The new plant (76,8 KWp) was built in the period Jan-Mar 2011 and start up in April 2011. In the first year (May 2011-Apr.2012) the new system produced 97.736 kWh. This production was almost the double of the previous production (the old plant in the same time produced 53.739 kWh). The whole plant in the first year (May 2011-Apr.2012) produced 151.475 kWh (97.736kwh +53.739 kWh).
- **Key result 2 – emission reduction:** In the first year (May 2011-Apr.2012) the new system caused the reduction of 52Ton of CO2, the old caused the reduction of 29Ton. The whole plant in the first year (May 2011-Apr.2012) produced the reduction of 81 Ton (52Ton + 29 Ton).
- **Key result 3 – emission reduction:** In the first year (May 2011-Apr.2012) the new system caused the saving of 22.5TOE, the saving of 12,4 TOE. The whole plant in the same period caused the saving of 34.8 TOE.

## C7 Future activities relating to the measure

No activities are foreseen for this measure except regular maintenance of the plant.

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## **D. Process Evaluation Findings**

### **D.0 Focused measure**

It is a focus measure which substitutes M. 07.02 “Freight distribution in Brescia”.

Considering that this measure is about an energy power plant, the available quantitative data were considered suitable for Cost Benefit analysis (see Annex 3).

### **D1 Deviations from the original plan**

The deviations from the original project/plan comprised:

- **Deviation 1 (project) New Measure proposal** – This measure substituted M 01.10 “New CNG fuelling station in Brescia” presented in the first DOW, in accordance with the topics and the budget foreseen in WP 1 of MODERN project. As it was introduced in the first amendment of the DOW this measure is shorter than the others.
- **Deviation 2 (plan) Time plan** – The delay registered in the formal approval of the DOW amendment led to a further delay in the start up of the measure: instead of starting at project month 17 it started five months later (month 22);
- **Deviation 3 (plan) Time plan** – there were also small delays with the entities involved (network manager and department of customs) due to the regulations for start up of the photovoltaic system.

### **D2 Barriers and drivers**

#### **D2.1 Barriers**

##### **Preparation phase:**

No barriers encountered.

##### **Implementation phase:**

- **Barrier 1: Financial barrier** – Regional funding to the Local Public Transport companies was reduced.
- **Barrier 2: Technological barrier** – Difficulties in finding the necessary devices for the photovoltaic plant because national funding was limited within a time period penalizing the systems installed after January 1st 2011. Everybody tried to install photovoltaic plans in 2010 and as a consequence inverter devices were sold out.
- **Barrier 3: Institutional barrier** – Late formal approval of the first contract amendment by the EC led to a delay in the start of the measure.

##### **Operation phase:**

No barriers encountered.

## **D2.2 Drivers**

### **Preparation phase:**

No drivers encountered.

### **Implementation phase:**

- **Driver 1: Political Driver** – The measure is in accordance with the policy of Brescia Trasporti and more generally with the policies of the city based on sustainable development. As a matter of fact the production of renewable energy obtains a reduction of CO2 emission in atmosphere and energy saving in terms of TOE.
- **Driver 2: Planning Driver** – There was an accurate planning of the technical requirements analysis and economical aspects necessary for the implementation of the new photovoltaic system based on improvement of the existing one.
- **Driver 3: Organizational Driver** – Agreements were taken with experienced installers.

### **Operation phase:**

No drivers encountered.

## **D2.2 Activities**

### **Implementation phase:**

A constructive partnership was created between Brescia Trasporti (and the holding Brescia Mobilità) and Brescia Municipality in order to develop common actions aiming at the reduction of CO2.

Therefore the implementation phase of the measure foresaw a shared design of the plant avoiding any possible contrast between Brescia Trasporti and Brescia Municipality.

## **D3 Participation**

### **D.3.1 Measure partners**

The partners of this measure are Brescia Mobilità and Brescia Trasporti.

**Brescia Trasporti** is the transportation public company of the Municipality of Brescia, and has a well-know leadership at national level in terms of a high-quality, competitive, modern transport service.

**Brescia Mobilità** is Brescia mobility agency and it is the holding of Brescia Trasporti.

### **D3.2 Participation of stakeholders**

The involvement of stakeholders isn't foreseen, considering that Brescia Trasporti is part of Brescia Mobilità and it has to stand by the advanced policy of Brescia Mobilità itself.

## **D4 Recommendations**

### **D.4.1 Recommendations: measure replication**

**Recommendation 1** - Research activities are important to define the executive design of a photovoltaic system according to the safety and innovativeness of the system itself

### **D.4.2 Recommendations: process**

**Recommendation 1** – Verify the availability of funding that can make the implementation of the measure easier

**Recommendation 2** – if funding is limited within a time period it may be possible to have a shortage of technical devices, due to a general rush.

## Annex 1: Historical data series for the BaU calculation

### Indicator 1 (Average Operating Revenues)

		YEAR 1												TOTALS YEAR 1	
		May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09		
Nominal power installed	kWp	50	50	50	50	50	50	50	50	50	50	50	50		
<b>PRODUCED ENERGY</b>	kWh	<b>7'351</b>	<b>6'345</b>	<b>7'577</b>	<b>6'835</b>	<b>3'295</b>	<b>2'495</b>	<b>1'203</b>	<b>850</b>	<b>863</b>	<b>1'929</b>	<b>3'230</b>	<b>4'270</b>	<b>46'243</b>	<b>KWH</b>
"conto energia" fare	€/kWh	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4		
Gross revenues from "conto energia"	€	2'940	2'538	3'031	2'734	1'318	998	481	340	345	772	1'292	1'708		
tax deduction 4%	€	118	102	121	109	53	40	19	14	14	31	52	68		
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>2'823</b>	<b>2'436</b>	<b>2'910</b>	<b>2'625</b>	<b>1'265</b>	<b>958</b>	<b>462</b>	<b>326</b>	<b>331</b>	<b>741</b>	<b>1'240</b>	<b>1'640</b>	<b>17'757</b>	<b>euro</b>
Energy cost (VAT excluded in bill)	€/kWh	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10		
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>735</b>	<b>635</b>	<b>758</b>	<b>684</b>	<b>330</b>	<b>250</b>	<b>120</b>	<b>85</b>	<b>86</b>	<b>193</b>	<b>323</b>	<b>427</b>	<b>4'624</b>	<b>euro</b>
<b>Total gross revenues (A+B)</b>	<b>€</b>	<b>3'558</b>	<b>3'071</b>	<b>3'667</b>	<b>3'308</b>	<b>1'595</b>	<b>1'208</b>	<b>582</b>	<b>411</b>	<b>418</b>	<b>934</b>	<b>1'563</b>	<b>2'067</b>	<b>22'382</b>	<b>euro</b>
excise UTF	€	56	56	56	56	56	56	56	56	56	56	56	56		
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>3'502</b>	<b>3'015</b>	<b>3'611</b>	<b>3'252</b>	<b>1'539</b>	<b>1'152</b>	<b>526</b>	<b>355</b>	<b>362</b>	<b>878</b>	<b>1'507</b>	<b>2'011</b>	<b>21'710</b>	<b>euro</b>

Tab.A1.1: data useful to calculate the revenue related to the year 1 (May 2008/April 2009)

		YEAR 2												TOTALS YEAR 2	
		May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10		
Nominal power installed	kWp	50	50	50	50	50	50	50	50	50	50	50	50		
<b>PRODUCED ENERGY</b>	kWh	<b>4'523</b>	<b>6'827</b>	<b>7'727</b>	<b>6'707</b>	<b>4'787</b>	<b>3'557</b>	<b>1'216</b>	<b>997</b>	<b>1'259</b>	<b>1'815</b>	<b>3'395</b>	<b>5'544</b>	<b>48'354</b>	<b>kWh</b>
"conto energia" fare	€/kWh	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4		
Gross revenues from "conto energia"	€	1'809	2'731	3'091	2'683	1'915	1'423	486	399	504	726	1'358	2'218		
tax deduction 4%	€	72	109	124	107	77	57	19	16	20	29	54	89		
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>1'737</b>	<b>2'622</b>	<b>2'967</b>	<b>2'575</b>	<b>1'838</b>	<b>1'366</b>	<b>467</b>	<b>383</b>	<b>483</b>	<b>697</b>	<b>1'304</b>	<b>2'129</b>	<b>18'568</b>	<b>euro</b>
Energy cost (VAT excluded in bill)	€/kWh	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10		
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>452</b>	<b>683</b>	<b>773</b>	<b>671</b>	<b>479</b>	<b>356</b>	<b>122</b>	<b>100</b>	<b>126</b>	<b>182</b>	<b>340</b>	<b>554</b>	<b>4'835</b>	<b>euro</b>
<b>Total gross revenues (A+B)</b>	<b>€</b>	<b>2'189</b>	<b>3'304</b>	<b>3'740</b>	<b>3'246</b>	<b>2'317</b>	<b>1'722</b>	<b>589</b>	<b>483</b>	<b>609</b>	<b>878</b>	<b>1'643</b>	<b>2'683</b>	<b>23'403</b>	<b>euro</b>

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excise UTF	€	55	55	55	55	55	55	55	55	55	55	55	0	
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>2'134</b>	<b>3'249</b>	<b>3'685</b>	<b>3'191</b>	<b>2'262</b>	<b>1'667</b>	<b>534</b>	<b>428</b>	<b>554</b>	<b>823</b>	<b>1'588</b>	<b>2'683</b>	<b>22'798</b> euro

Tab.A1.2: data useful to calculate the revenue related to the year 2 (May 2009/April 2010)

		YEAR 3												TOTALS YEAR 3	
		May-10	Jun-10	Jul-10	Aug-10	Sep-10	Oct-10	Nov-10	Dec-10	Jan-11	Feb-11	Mar-11	Apr-11		
Nominal power installed	kWp	50	50	50	50	50	50	50	50	50	50	50	126,8		
<b>PRODUCED ENERGY</b>	kWh	<b>6'413</b>	<b>6'881</b>	<b>7'670</b>	<b>6'386</b>	<b>4'814</b>	<b>2'894</b>	<b>1'468</b>	<b>880</b>	<b>1'522</b>	<b>2'294</b>	<b>3'853</b>	<b>6'034</b>	<b>51'109</b>	kWh
"conto energia" fare	€/kWh	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4		
Gross revenues from "conto energia"	€	2'565	2'752	3'068	2'554	1'926	1'158	587	352	609	918	1'541	2'414		
tax deduction 4%	€	103	110	123	102	77	46	23	14	24	37	62	97		
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>2'463</b>	<b>2'642</b>	<b>2'945</b>	<b>2'452</b>	<b>1'849</b>	<b>1'111</b>	<b>564</b>	<b>338</b>	<b>584</b>	<b>881</b>	<b>1'480</b>	<b>2'317</b>	<b>19'626</b>	euro
Energy cost (VAT excluded in bill)	€/kWh	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10		
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>641</b>	<b>688</b>	<b>767</b>	<b>639</b>	<b>481</b>	<b>289</b>	<b>147</b>	<b>88</b>	<b>152</b>	<b>229</b>	<b>385</b>	<b>603</b>	<b>5'109</b>	euro
<b>Total gross revenues (A+B)</b>	<b>€</b>	<b>3'104</b>	<b>3'330</b>	<b>3'712</b>	<b>3'091</b>	<b>2'330</b>	<b>1'401</b>	<b>711</b>	<b>426</b>	<b>737</b>	<b>1'110</b>	<b>1'865</b>	<b>2'920</b>	<b>24'737</b>	euro
excise UTF	€	0	30	48	48	48	48	48	48	30	30	30	30		
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>3'104</b>	<b>3'300</b>	<b>3'664</b>	<b>3'043</b>	<b>2'282</b>	<b>1'353</b>	<b>663</b>	<b>378</b>	<b>707</b>	<b>1'080</b>	<b>1'435</b>	<b>2'890</b>	<b>23'899</b>	euro

Tab.A1.3: data useful to calculate the revenue related to the year 3 (May 2010/April 2011)

## Indicator 2 (Fuel mix)

BRESCIA TRASPORTI - Fleet composition 31/12/2009	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	total
Fuel type	gasoline	gasoline	gasoline	gasoline	methane	methane - electric	
N. autobus	21	12	14	38	106	4	<b>195</b>
%	11%	6%	7%	19%	54%	2%	

Tab.A1.4: Brescia Trasporti Fleet composition (31/12/2009)

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Mileage and fuel consumption	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID		TOTAL	
						methane	electric		
km travelled in 2009	520'811	470'463	508'843	1'199'516	5'458'189	69'938	29'973	<b>8'257'733</b>	
%	6,33%	5,72%	6,18%	14,58%	66,34%	1,21%			
Factor consumption (km / lt - mc or kWh/km)	2,0287	2,0287	2,0287	2,0287	1,4613	1,4613	1,25		
Fuel consumption by type (lt - mc-KWH)	256'722	231'904	250'822	591'273	3'735'160	47'860	37'467		
Fuel consumption by type (kg - mc)	1'111'152								
Fuel consumption by type MJ	45'557'222					128'676'255	1'648'774	134'880	<b>175'882'251</b>
Fuel mix %	25,90%					73,16%	1,01%		

Tab.A1.5: data useful to calculate the indicator "fuel mix"

**Indicator 3** (Energy consumption for hybrid bus/tot fuel produced by solar plan)

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YEAR	2009
Tot km travelled by hybrid busses	99 911
30% by electric fuel	29 973
70% by methan fuel	69 938
Average consumption by electric busses (kwh/km)	1,25

YEAR	2009
B = energy consumption by electric bus(kwh/year)	37 467
C = energy produced by solar plant (kwh/year)	46 633
<b>A = Energy consumption (B/C) = Indicator 3</b>	<b>80,34%</b>

Tab.A1.6: data useful to calculate the indicator “energy consumption”

#### Indicator 4 (CO emissions)

Calculation CO emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	
km traveled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911	
CO emission factor (g/km)	2,2	1,9	1,9	1,69	0,721	0,530	<b>TOT</b>
CO emission per year (kg/year)	1.146	894	967	2.027	3.935	53,0	<b>9.022</b>

Tab.A1.7: data useful to calculate the indicator “CO emission”

#### Indicator 5 (NOx emissions)

Calculation NOx emission per year (kg)	diesel EURO 0+cr1	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	
km travelled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911	
NOx emission factor (g/km)	12,8	9,04	9,04	9,36	3,584	0,980	<b>TOT</b>
NOx emission per year (kg/year)	6.666	4.253	4.600	11.227	19.562	98	<b>46.407</b>

Tab.A1.8: data useful to calculate the indicator "NOx emissions"

**Indicator 6 (Small particulate emissions)**

Calculation PT emission per year (kg)	diesel EURO 0+cr1	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	
km travelled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911	
SP emission factor (g/km)	0,0268	0,358	0,0268	0,194	0,009	0,017	<b>TOT</b>
SP emission per year (kg/year)	14	168	14	233	49	2	<b>480</b>

Tab.A1.9: data useful to calculate the indicator "Small particulate emissions"

**Indicator 7 (CO2 emission avoided)**

CO2 AVOIDED	2008(*)	2009
B = energy produced by solar plant (kwh/year)	35'922	46'633
C = Emission factor (kgCO2/kwh)	0,531	0,531
D = CO2 avoided (kg/year)	19'075	24'762

(\*) The plant was put into service on 1<sup>st</sup> May 2008. Production refers to the period that goes from May to December 2008

Tab.A1.10: data useful to calculate the indicator "CO2 emissions avoided"

**Indicator 8** (*% Km Hybrid bus*)

<i>KM HYBRID BUS</i>	2008	2009
B = tot km travelled by hybrid bus	95.909	99.911
C = tot km travelled by fleet	8.491.903	8.257.733
A= % km hybrid bus (B/C)	1,13%	1,21%

*Tab.A1.11: data useful to calculate the indicator “% Km Hybrid bus”*

## Annex 2: Ex ante and Ex Post data collection

### Indicator 1 (Average Operating Revenues)

		YEAR 1												TOTALS YEAR 1
		May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Jan-09	Feb-09	Mar-09	Apr-09	
Nominal power installed	kWp	50	50	50	50	50	50	50	50	50	50	50	50	
<b>PRODUCED ENERGY</b>	kWh	<b>7'351</b>	<b>6'345</b>	<b>7'577</b>	<b>6'835</b>	<b>3'295</b>	<b>2'495</b>	<b>1'203</b>	<b>850</b>	<b>863</b>	<b>1'929</b>	<b>3'230</b>	<b>4'270</b>	<b>46'243 KWH</b>
"conto energia" fare	€/kWh	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4	
Gross revenues from "conto energia"	€	2'940	2'538	3'031	2'734	1'318	998	481	340	345	772	1'292	1'708	
tax deduction 4%	€	118	102	121	109	53	40	19	14	14	31	52	68	
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>2'823</b>	<b>2'436</b>	<b>2'910</b>	<b>2'625</b>	<b>1'265</b>	<b>958</b>	<b>462</b>	<b>326</b>	<b>331</b>	<b>741</b>	<b>1'240</b>	<b>1'640</b>	<b>17'757 euro</b>
Energy cost (VAT excluded in bill)	€/kWh	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	0,10	
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>735</b>	<b>635</b>	<b>758</b>	<b>684</b>	<b>330</b>	<b>250</b>	<b>120</b>	<b>85</b>	<b>86</b>	<b>193</b>	<b>323</b>	<b>427</b>	<b>4'624 euro</b>
<b>Total gross revenues (A+B)</b>	<b>€</b>	<b>3'558</b>	<b>3'071</b>	<b>3'667</b>	<b>3'308</b>	<b>1'595</b>	<b>1'208</b>	<b>582</b>	<b>411</b>	<b>418</b>	<b>934</b>	<b>1'563</b>	<b>2'067</b>	<b>22'382 euro</b>
excise UTF	€	56	56	56	56	56	56	56	56	56	56	56	56	
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>3'502</b>	<b>3'015</b>	<b>3'611</b>	<b>3'252</b>	<b>1'539</b>	<b>1'152</b>	<b>526</b>	<b>355</b>	<b>362</b>	<b>878</b>	<b>1'507</b>	<b>2'011</b>	<b>21'710 euro</b>

Tab.A2.1: data useful to calculate the revenue related to the year 1 (May 2008/April 2009)

### Ex post data collection (year 2011)

This are revenues derive from:

- government funding per each kWh produced by the equipment (0,40 €/kWh for the existing equipment – 0,384 €/kWh for the new equipment),
- revenues due to economic saving in electric bill (0,10 €/kWh)
- revenues due to energy put in electricity network (0,103 €/kWh)

net of deductions and excises. The production data (kWh produced) are obtained monthly through electricity meter of photovoltaic power system.

		mag-11	giu-11	lug-11	ago-11	set-11	ott-11	nov-11	dic-11
Nominal power installed	kWp	126,8	126,8	126,8	126,8	126,8	126,8	126,8	126,8
<b>Produced energy (old plant)</b>	kWh	7'568	6'317	7'197	7'571	5'002	3'892	1'888	1'248
<b>Produced energy (new plant)</b>	kWh	17'820	10'900	12'386	12'744	8'460	6'750	3'450	2'323
<b>PRODUCED ENERGY</b>	<b>kWh</b>	<b>39'091</b>	<b>56'308</b>	<b>75'891</b>	<b>96'206</b>	<b>109'668</b>	<b>120'310</b>	<b>125'648</b>	<b>129'219</b>
"conto energia" fare (old plant)	€/kWh	0,4	0,4	0,4	0,4	0,4	0,4	0,4	0,4
"conto energia" fare (new plant)	€/kWh	0,384	0,384	0,384	0,384	0,384	0,384	0,384	0,384
Gross revenues from "conto energia" (old plant)	€	3'027	2'527	2'879	3'028	2'001	1'557	755	499
Gross revenues from "conto energia" (new plant)	€	6'843	4'186	4'756	4'894	3'249	2'592	1'325	892
tax deduction 4%	€	395	268	305	317	210	166	83	56
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>9'475</b>	<b>6'444</b>	<b>7'330</b>	<b>7'605</b>	<b>5'039</b>	<b>3'983</b>	<b>1'997</b>	<b>1'336</b>
Energy cost (VAT excluded in bill)	€	0,1	0,1	0,1	0,1	0,1	0,1	0,1	0,1
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>2'539</b>	<b>1'722</b>	<b>1'958</b>	<b>2'032</b>	<b>1'346</b>	<b>1'064</b>	<b>534</b>	<b>357</b>
Energy put in the network	kWh	0	2'400	1'200	1'200	0	0	0	0
<b>Price of the energy put in the network (VAT excluded)</b>	<b>€/kWh</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>
<b>C) Revenues from the energy put in the network</b>	<b>€</b>	<b>0</b>	<b>247</b>	<b>124</b>	<b>124</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTAL GROSS REVENUES (A+B+C)</b>	<b>€</b>	<b>12'014</b>	<b>8'413</b>	<b>9'412</b>	<b>9'760</b>	<b>6'386</b>	<b>5'047</b>	<b>2'531</b>	<b>1'693</b>
excise UTF	€	30	30	30	30	30	30	30	30
maintenance cost	€					900			
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>11'984</b>	<b>8'383</b>	<b>9'382</b>	<b>9'730</b>	<b>5'456</b>	<b>5'017</b>	<b>2'501</b>	<b>1'663</b>
<b>TOTAL CUMULATED NET REVENUES</b>	<b>€</b>	<b>18'096</b>	<b>26'479</b>	<b>35'861</b>	<b>45'591</b>	<b>51'047</b>	<b>56'064</b>	<b>58'564</b>	<b>60'227</b>

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		gen-12	feb-12	mar-12	apr-12
Nominal power installed	kWp	50	50	50	126,8
Produced energy (old plant)	kWh	2054	1685	4564	4753
Produced energy (new plant)	kWh	3780	2820	7980	8323
<b>PRODUCED ENERGY</b>	<b>kWh</b>	<b>5834</b>	<b>10339</b>	<b>22883</b>	<b>35959</b>
"conto energia" fare (old plant)	€/kWh	0,4	0,4	0,4	0,4
"conto energia" fare (new plant)	€/kWh	0,384	0,384	0,384	0,384
Gross revenues from "conto energia" (old plant)	€	822	674	1826	1901
Gross revenues from "conto energia" (new plant)	€	1452	1083	3064	3196
tax deduction 4%	€	91	70	196	204
<b>A) Net revenues from "conto energia"</b>	<b>€</b>	<b>2182</b>	<b>1687</b>	<b>4694</b>	<b>4893</b>
Energy cost (VAT excluded in bill)	€	0,1	0,1	0,1	0,1
<b>B) Revenues from bill savings</b>	<b>€</b>	<b>583</b>	<b>451</b>	<b>1254</b>	<b>1308</b>
Energy put in the network	kWh	0	0	1'200	0
<b>Price of the energy put in the network (VAT excluded)</b>	<b>€/kWh</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>	<b>0,103</b>
<b>C) Revenues from the energy put in the network</b>	<b>€</b>	<b>0</b>	<b>0</b>	<b>124</b>	<b>0</b>
<b>TOTAL GROSS REVENUES (A+B+C)</b>	<b>€</b>	<b>2766</b>	<b>2137</b>	<b>6072</b>	<b>6201</b>
excise UTF	€	30	30	30	30
maintenance cost	€			400	
<b>TOTAL NET REVENUES</b>	<b>€</b>	<b>2736</b>	<b>2107</b>	<b>5642</b>	<b>6171</b>
<b>TOTAL CUMULATED NET REVENUES</b>	<b>€</b>	<b>2736</b>	<b>4843</b>	<b>10485</b>	<b>16656</b>

Tab.A2.2: data useful to calculate the revenue related to the year May 2011/April 2012

**Indicator 2 (Fuel mix) Ex ante: year 2009**

Mileage and fuel consumption	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID		TOTAL	
						methane	electric		
km travelled in 2009	520'811	470'463	508'843	1'199'516	5'458'189	69'938	29'973	<b>8'227'760</b>	
%	6,33%	5,72%	6,18%	14,58%	66,34%	1,21%			
Factor consumption (km / lt - mc - kWh)	2,0287	2,0287	2,0287	2,0287	1,4613	1,4613	1,25		
Fuel consumption by type (lt - mc-KWH)	256'722	231'904	250'822	591'273	3'735'160	47'860	37'467		
Fuel consumption by type (kg - mc)	1'111'152								
Fuel consumption by type MJ	45'557'222					128'676'255	1'648'774	134'880	<b>175'882'251</b>
Fuel mix %	25,90%					73,16%	1,01%		

Tab.A2.3: data useful to calculate the indicator "fuel mix" (year 2009)

Fleet composition 2011	diesel euro 0+crt	diesel euro 1	diesel euro 1+crt	diesel euro 2	diesel euro 2+crt	methan gas	hybrid (electric-methane)	TOT
n. autobus	21	11	14	9	29	113	6	<b>203</b>
% sul totale	10%	5%	7%	4%	14%	56%	3%	

Tab.A2.4: Brescia Trasporti Fleet composition in 2011

Ex post:

Measure title: **Renewable Energy Production to Feed Buses with Low Environmental Impact**

City: **BRESCIA**

Project: **MODERN**

Measure number: **01.11**

Mileage and fuel consumption	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	diesel EURO 2+CRT	METHAN GAS	HYBRID		TOTAL	
							methan	electric		
km traveled in 2011	416.351	222.225	419.223	149.254	951.163	5.845.017	70.910	30.390	<b>8.104.533</b>	
%	5,14%	2,74%	5,17%	1,84%	11,74%	72,12%	1,25%			
Factor consumption (km / lt - mc - kwh)	2,0176	2,0176	2,0176	2,0176	2,0176	1,467	1,467	1,25	<b>175.683.237</b>	
Fuel consumption by type (lt - mc-KWH)	206.360	110.143	207.783	73.976	471.433	3.984.333	48.337	37.988		
Fuel consumption by type (kg - mc)	893.195									
Fuel consumption by type MJ	36.620.998						137.260.283	1.665.201	136.755	<b>175.683.237</b>
Fuel mix %	20,84%						78,13%	<b>1,03%</b>		

Tab.A2.5: data useful to calculate the indicator "fuel mix" (year 2011)

**Indicator 3** (Energy consumption for hybrid bus/tot fuel produced by solar plan) The Ex ante situation refers to year 2009, 2010:

year	2009	2010	2011
<i>tot km travelled by hybrid bus</i>	99.911	93283	101.300
30% by electric fuel	29.973	27.985	30.390
70% by methane fuel	69.938	65.298	51.772

average consumption by electric bus (kWh/km)	1,25
--	------

year	2009	2010	2011
B = energy consumption by electric bus(kWh/year)	37.467	34.981	37.988
C = energy produced by existing solar plant (kWh/year)	46.633	49.419	52.864
D = energy produced by <b>new</b> solar plant (kWh/year)			74.833
E = TOT energy produced by solar plant (kWh/year) (C+D)	46.633	49.419	127.697
A = Energy consumption (B/E)	80,34%	70,78%	29,75%

B = energy consumption (only new solar plant (B/D))

50,76%

Tab.A2.6: data useful to calculate the indicator “energy consumption”

**Indicator 4 (CO emissions)** Ex ante situation is referred to year 2009.

Calculation CO emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	TOT
km traveled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911	
CO emission factor (g/km)	2,2	1,9	1,9	1,69	0,721	0,530	
CO emission per year (kg/year)	1.146	894	967	2.027	3.935	53,0	<b>9.022</b>

Tab.A2.7: data useful to calculate the indicator “CO emission” year 2009

Ex post:

Calculation CO emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	diesel EURO 2+CRT	METHANE GAS	HYBRID	TOT
km travelled in 2011	416.351	222.225	419.223	149.254	951.163	5.845.017	101.300	<b>8.104.533</b>
CO emission factor (g/km)	2,2	1,9	1,9	1,69	1,69	0,721	0,530	
CO emission per year (kg/year)	916	422	797	252	1.607	4.214	53,7	<b>8.262</b>

Tab.A2.8: data useful to calculate the indicator “CO emission” year 2011

**Indicator 5 (NOx emissions)** Ex ante situation is referred to year 2009.

Calculation NOx emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID	
km travelled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911	
NOx emission factor (g/km)	12,8	9,04	9,04	9,36	3,584	0,980	<b>TOT</b>
NOx emission per year (kg/year)	6.666	4.253	4.600	11.227	19.562	98	<b>46.407</b>

Tab.A2.9: data useful to calculate the indicator "NOx emission" year 2009

Ex post:

Calculation NOx emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	diesel EURO 2+CRT	METHANE GAS	HYBRID	TOT
km travelled in 2011	416.351	222.225	419.223	149.254	951.163	5.845.017	101.300	<b>8.104.533</b>
Nox emission factor (g/km)	12,8	9,04	9,04	9,36	9,36	3,584	0,980	
Nox emission per year (kg/year)	5.329	2.009	3.790	1.397	8.903	20.949	99	<b>42.476</b>

Tab.A2.10: data useful to calculate the indicator "NOx emission" year 2011

**Indicator 6 (Small particulate emissions)** Ex ante situation is referred to year 2009.

Calculation PT emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	METHANE GAS	HYBRID
km travelled in 2009	520.811	470.463	508.843	1.199.516	5.458.189	99.911

SP emission factor (g/km)	0,0268	0,358	0,0268	0,194	0,009	0,017	<b>TOT</b>
SP emission per year (kg/year)	14	168	14	233	49	2	<b>480</b>

Tab.A2.11: data useful to calculate the indicator "Small particulate emissions" year 2009

Ex post:

Calculation PT emission per year (kg)	diesel EURO 0+crt	diesel EURO 1	diesel EURO 1+CRT	diesel EURO 2	diesel EURO 2+CRT	METHANE GAS	HYBRID	TOT
km travelled in 2011	416.351	222.225	419.223	149.254	951.163	5.845.017	101.300	<b>8.104.533</b>
PT emission factor (g/km)	0,0268	0,358	0,0268	0,194	0,0268	0,009	0,017	
PT emission per year (kg/year)	11	80	11	29	25	53	2	<b>211</b>

Tab.A2.12: data useful to calculate the indicator "Small particulate emissions" year 2011

**Indicator 7** (CO2 emission avoided) Ex ante situation is referred to year 2008, 2009 and 2010.

CO2 AVOIDED	2008(*)	2009	2010	2011
A = energy produced by existing solar plant (kWh/year)	35.922	46.633	49414	52864
B = energy produced by <b>new</b> solar plant (kWh/year)				74833
C = Emission factor (kgCO2/kWh)	0,531	0,531	0,531	0,531
<b>D = CO2 avoided (kg/year)</b>	<b>19.075</b>	<b>24.762</b>	<b>26.239</b>	<b>67.807</b>

Tab.A2.13: data useful to calculate the indicator "CO2 emission avoided" year 2008-2011

**Indicator 8** (% Km Hybrid bus) Ex ante situation is referred to year 2009

KM HYBRID BUS	2009	2010	2011
B = tot km travelled by hybrid bus	99.911	93.283	101.300

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C = tot km travelled by fleet	8.257.733	8.264.227	8.104.533
A= % km hybrid bus (B/C)	1,21%	1,13%	1,25%

*Tab.A2.14: data useful to calculate the indicator “% Km Hybrid bus” year 2009-2011*

## Annex 3: Cost Benefit Analysis

### Evaluation period for CBA

The reference year is 2011 and the CBA time horizon coincides with the technical/economic life time of the photovoltaic system (20 years; final CBA year: 2030), longer than the technical/economic life time of the new purchased buses (15 years).

### Method and values for modification

This specific cost/benefit analysis (CBA) is referred exclusively to the actions implemented with CIVITAS support regarding the renewable energy production to feed buses with low environmental impact (Measure M01.11).

Therefore, the new additional photovoltaic system, operating from April 2011, and n.2 new hybrid buses, registered in February 2011, have been taken into consideration.

The previous 50 kWp photovoltaic system, implemented in 2008 by Brescia Trasporti, and the first 4 hybrid busses, purchased in 2003, haven't been considered in this CBA, because they haven't been financed by the CIVITAS initiative. As a consequence, the maintenance costs and the operative revenues deriving from the oldest part of the plant have been neglected. Only the contribution coming from the new part of the plant (co-financed by the Civitas initiative) has been taken into consideration.

The nominal power of the new part of the photovoltaic system is 76,8 kWp and the yearly potential energy production is approx. 100.000 kWh (74.833 kWh have been produced from April 2011 to December 2011).

The total investment cost is 215.540 €2011 (supply of inverters and photovoltaic modules: 177.760 €; other components and installation: 37.780 €).

The plant maintenance costs have been estimated approx. 1.000 €/year

The cost of two new hybrid busses is 415.000 €2011/each and the yearly mileage is 23.000 km/each, of which 7.000 km supported only by electrical batteries.

The CBA takes into consideration the investment costs of the new photovoltaic system/hybrid busses and the consequent variations of the emission costs (reduction of 0,531 kg CO<sub>2</sub>/kWh with photovoltaic production and zero CO<sub>2</sub>, CO, NO<sub>x</sub> and PM emissions with electrical battery use of the new hybrid busses) and of the maintenance costs (the drivers cost has been evaluated unchanged).

The emission quantities of the main environmental polluting agents are shown in Table A3.1 referred to a 12 m methane bus: grams of carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM) referred to the energy consumption of 1 kilowatt-hour. As first approximation, the same polluting emission quantities have been assumed for the different methane bus types (8 m vs 12 m long).

TABLE A3.1 – Polluting emission factors referred to a methane bus

EMISSION FACTOR	METHANE BUS
CO emission factor (g/kWh)	2,53
NO <sub>x</sub> emission factor (g/kWh)	0,38
PM emission factor (g/kWh)	0,003
CO <sub>2</sub> emission factor (g/kWh)	206,45

Source: Brescia Mobilità – EURO Normative

The money return of the environmental benefits has been carried out basing on EU data, as agreed during the CIVITAS meeting in Funchal: in particular, the figures (total external costs in urban zone) referred to the main polluting agents (CO, NOx, PM and CO<sub>2</sub>) taken into consideration in the CBA, are shown in Table A3.2 and are referred to Euro 2011.

TABLE A3.2 – Money return of the main polluting agents (€2011/Kg)

EMISSION TYPE	ESTERNAL COST (€2011/kg)
CO emission (*)	0,004
NOx emission (**)	3,830
PM emission (**)	442,848
CO2 emission (**)	0,113

Source: (\*) Astra – Scenario Low External Cost - 2005

(\*\*) HEATCO, D5 Proposal for harmonized Guidelines – Brussels, 2006

Any action able to modify the transport service has been implemented (i.e. variations of the runs number and/or of the means capacity), therefore the traffic revenues are unchanged.

The following economic items (referred to year 2011) have been calculated:

- Net Present Value (NPV)
- B/C ratio
- Investment return rate (IRR).

In particular, CBA has been carried out comparing the scenario Business-as-Usual (Scenario 0: hypothetical situation without CIVITAS actions) with the effective scenario (Scenario 1), which includes the actions implemented thanks to the CIVITAS funding.

### **Scenario 0 (Reference case or BaU)**

The energy production and the transport service have been kept constant respect to the CIVITAS operational phase (year 2011). As a consequence, the energy consumption and the pollutant emissions, which vary depending on the mileage, are constant and equal the CBA base year values.

It is assumed that the 8 m buses are substitute at the end of their technical/economic life (15 years) with new 8 m methane busses (no hybrid type). The hypothetical purchase cost has been estimated 274.000 €2011/bus (approx. 33% lower than hybrid busses).

The total residual value of the busses at 2030 has been evaluated 365.200 €2011.

The maintenance costs have been estimated on the base of the yearly kilometrical values, supposed as first approximation to equal the costs of 12 m methane busses and shown in detail in Table A3.3 (average yearly value: 6.879 €/year).

TABLE A3.3 – SCENARIO 0: kilometrical maintenance costs for each methane bus age

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bus City Class Methane 12 m (€/Km)	0,0277	0,0978	0,1560	0,2507	0,1696	0,2703	0,3772	0,4672	0,1664	0,1660	0,4883	0,2192	0,2347	0,2505	1,1448

Source: Brescia Mobilità

As already mentioned in the introduction to this CBA, the contribution deriving from the oldest part of the plant have been neglected, because it has been realized before Civitas. Therefore, only the contribution coming from the new part of the plant (co-financed by the Civitas initiative) has been taken into consideration for the calculation of the maintenance costs and the operative revenues.

### Scenario 1 (Civitas measure)

In this scenario, the situation generated by the Civitas action has been taken into consideration: the new part of the photovoltaic plant (producing 76,8 kWp since 2011) and the purchase, in 2011, of n.2 new hybrid busses have been considered for the calculation of the CBA parameters.

The total investment cost regarding the purchase of the new photovoltaic system and of n.2 hybrid busses (2011) is 1.045.540 €2011 and the residual value at 2030 is estimated 553.333 €2011.

The average yearly maintenance costs of the photovoltaic system and of each hybrid bus are estimated respectively 1.000 €/year and 4.035 €/year.

In particular, the maintenance cost during the hybrid bus life has been distributed in the period of 15 years (see Table A3.4), adopting as first approximation in proportional way the same yearly distribution of the methane bus cost.

TABLE A3.4 – SCENARIO 1: kilometrical maintenance costs for each hybrid bus age

YEAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Bus Methane/Hybrid (€/Km)	0,0162	0,0574	0,0915	0,1470	0,0995	0,1586	0,2213	0,2740	0,0976	0,0974	0,2864	0,1286	0,1376	0,1469	0,6715

Source: Brescia Mobilità

The following tables (from A3.5 to A3.11) show the detailed CBA for each year of the time horizon considered (2011-2030).

### Life time cost and benefit

Table A3.5 Busses Capital cost in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	€830,000
	Reference case (or BAU)	€547,800
Year 2012	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2013	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2014	CIVITAS measure	-
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2015	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2016	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2017	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2018	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2019	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2020	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2021	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2022	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2023	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2024	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2025	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2026	CIVITAS measure	€830,000
	Reference case (or BAU)	€547,800
Year 2027	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2028	CIVITAS measure	-
	Reference case (or BAU)	-
Year 2029	CIVITAS measure	-
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2030	CIVITAS measure	-
	Reference case (or BAU)	-

Table A3.6 Photovoltaic system Capital cost in the evaluation period (not discounted)

	Cases for comparison	Cost (e.g. €200,000)
Year 2011	CIVITAS measure	€215,540
	Reference case (or BAU)	-

Table A3.7 Busses Maintenance cost in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	€747
	Reference case (or BAU)	€1,274
Year 2012	CIVITAS measure	€2,640
	Reference case (or BAU)	€4,500
Year 2013	CIVITAS measure	€4,209
	Reference case (or BAU)	€7,175
Year 2014	CIVITAS measure	€6,764
	Reference case (or BAU)	€11,532
Year 2015	CIVITAS measure	€4,575
	Reference case (or BAU)	€7,800
Year 2016	CIVITAS measure	€7,294
	Reference case (or BAU)	€12,436
Year 2017	CIVITAS measure	€10,179
	Reference case (or BAU)	€17,353
Year 2018	CIVITAS measure	€12,606
	Reference case (or BAU)	€21,492
Year 2019	CIVITAS measure	€4,489
	Reference case (or BAU)	€7,663
Year	CIVITAS measure	€4,479

	Cases for comparison	Cost
2020	Reference case (or BAU)	€7,636
Year 2021	CIVITAS measure	€13,175
	Reference case (or BAU)	€22,462
Year 2022	CIVITAS measure	€5,916
	Reference case (or BAU)	€10,085
Year 2023	CIVITAS measure	€6,331
	Reference case (or BAU)	€10,794
Year 2024	CIVITAS measure	€6,578
	Reference case (or BAU)	€11,522
Year 2025	CIVITAS measure	€30,889
	Reference case (or BAU)	€52,663
Year 2026	CIVITAS measure	€747
	Reference case (or BAU)	€1,274
Year 2027	CIVITAS measure	€2,640
	Reference case (or BAU)	€4,500
Year 2028	CIVITAS measure	€4,209
	Reference case (or BAU)	€7,175
Year 2029	CIVITAS measure	€6,764
	Reference case (or BAU)	€11,532
Year 2030	CIVITAS measure	€4,575
	Reference case (or BAU)	€7,800

Table A3.8 Photovoltaic system Maintenance cost in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	€750
	Reference case (or BAU)	-
Year 2012	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2013	CIVITAS measure	€1,000
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2014	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2015	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2016	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2017	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2018	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2019	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2020	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2021	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2022	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2023	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2024	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2025	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2026	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2027	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2028	CIVITAS measure	€1,000
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2029	CIVITAS measure	€1,000
	Reference case (or BAU)	-
Year 2030	CIVITAS measure	€1,000
	Reference case (or BAU)	-

Table A3.9 Photovoltaic system Operating revenues in the evaluation period (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	€28.596
	Reference case (or BAU)	-
Year 2012	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2013	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2014	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2015	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2016	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2017	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2018	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2019	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2020	CIVITAS measure	€41.148
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2021	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2022	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2023	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2024	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2025	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2026	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2027	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2028	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2029	CIVITAS measure	€41.148
	Reference case (or BAU)	-
Year 2030	CIVITAS measure	€41.148
	Reference case (or BAU)	-

Table A3.10 Busses Environmental emissions (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2012	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2013	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year	CIVITAS measure	-

	Cases for comparison	Cost
2014	Reference case (or BAU)	€2,384
Year 2015	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2016	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2017	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2018	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2019	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2020	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2021	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2022	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2023	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2024	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2025	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2026	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2027	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year 2028	CIVITAS measure	-
	Reference case (or BAU)	€2,384
Year	CIVITAS measure	-

	Cases for comparison	Cost
2029	Reference case (or BAU)	€2,384
Year 2030	CIVITAS measure	-
	Reference case (or BAU)	€2,384

Table A3.11 Photovoltaic system Environmental emissions (not discounted)

	Cases for comparison	Cost
Year 2011	CIVITAS measure	€4,475
	Reference case (or BAU)	-
Year 2012	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2013	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2014	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2015	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2016	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2017	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2018	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2019	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2020	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2021	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2022	CIVITAS measure	€4,593
	Reference case (or BAU)	-

	Cases for comparison	Cost
Year 2023	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2024	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2025	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2026	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2027	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2028	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2029	CIVITAS measure	€4,593
	Reference case (or BAU)	-
Year 2030	CIVITAS measure	€4,593
	Reference case (or BAU)	-

### Summary of CBA results

The CBA has been carried out comparing the two scenarios previously described.

The average yearly interest rate estimated in the CBA is 3,5%.

Table A3.12 shows the main results of the CBA (net present value, benefits/costs ratio, investment rate return), referred to the final year 2030.

TABLE A3.12 – CBA results between Scenario 1 and Scenario 0 (year 2030)

<b>SCENARIO 1 vs SCENARIO 0</b>	
INTEREST RATE	3,5%
NET PRESENT VALUE (€ 2011)	176.529
BENEFITS/COSTS RATIO	1,56
I.R.R.	7,8%

It's possible to say that the purchase of n.2 hybrid buses and of the additional photovoltaic system (Scenario 1) is re-paid in approx. 12 years (NPV>0 at 2022), thanks to:

- the use of a part photovoltaic energy to feed the new hybrid busses;
- the sale of the remaining third of photovoltaic energy (surplus);
- the lower maintenance and emission costs in scenario 1 (Civitas measure) respect to Scenario 0 (Business-as-Usual), which hypothetically foresees to keep unchanged the situation before the CIVITAS operational phase.

The CBA calculation is shown in the following table and all the figures are referred to Euro 2011

Measure title: Renewable Energy Production to Feed Buses with Low Environmental Impact

City: BRESCIA

Project: MODERN

Measure number: 01.11

TABLE A3.13 – CBA - Scenario 1 vs. Scenario 0

**MEASURE M01.11 - RENEWABLE ENERGY PRODUCTION TO FEED BUSES WITH LOW ENVIRONMENTAL IMPACT**  
 COSTS/BENEFITS ANALYSIS - Scenario 1 vs Scenario 0

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
<b>SCENARIO 0 - Business as Usual: with traditional energy production and traditional methane buses</b>																				
Busses investment costs	547.800	-	-	-	-	-	-	-	-	-	-	-	-	-	-	547.800	-	-	-	-
Busses residual value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	365.200
Busses operating revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Busses maintenance costs	1.274	4.500	7.175	11.532	7.800	12.436	17.353	21.492	7.653	7.636	22.462	10.085	10.794	11.522	52.663	1.274	4.500	7.175	11.532	7.800
Busses emissions	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384	2.384
<b>SCENARIO 1 - CIVITAS support: with new photovoltaic energy production and n.2 new hybrid buses</b>																				
Photovoltaic system investment costs	215.540	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Photovoltaic system operating revenues	28.596	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148
Photovoltaic system maintenance costs	750	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Photovoltaic emissions	4.475	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593	4.593
Busses investment costs	830.000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	830.000	-	-	-	-
Busses residual value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	553.333
Busses operating revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Busses maintenance costs	747	2.640	4.209	6.764	4.575	7.294	10.179	12.606	4.489	4.479	13.175	5.916	6.331	6.758	30.889	747	2.640	4.209	6.764	4.575
Busses emissions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>SCENARIO 1 vs SCENARIO 0</b>																				
Investment costs	497.740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	282.200	-	-	-	-
Residual value	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	188.133
Operating revenues	28.596	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148	41.148
Maintenance costs	223	861	1.967	3.768	2.225	4.142	6.175	7.896	2.164	2.157	8.257	3.170	3.463	3.764	20.774	473	861	1.967	3.768	2.225
Emissions	6.859	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977	6.977
TOTAL	462.509	48.986	50.092	51.893	50.350	52.267	54.300	56.011	50.299	50.282	56.412	51.295	51.588	51.889	68.899	234.548	48.986	50.092	51.893	238.483
OVERALL TOTAL	462.509	413.523	363.431	311.538	261.188	208.921	154.821	98.610	48.321	1.961	58.374	109.669	161.256	213.145	282.044	47.496	96.481	146.573	198.466	436.949
TOTAL BENEFIT	35.455	48.986	50.092	51.893	50.350	52.267	54.300	56.011	50.289	50.282	56.412	51.295	51.588	51.889	68.899	48.125	48.986	50.092	51.893	238.483
TOTAL COST	497.963	-	-	-	-	-	-	-	-	-	-	-	-	-	-	282.673	-	-	-	-
<b>INTEREST RATE</b>																				
INTEREST RATE	3.5%																			
NET PRESENT VALUE	446.868	401.139	355.960	310.738	268.345	225.825	183.146	140.611	103.712	68.066	29.426	4.520	37.505	69.561	110.686	24.579	2.716	29.683	56.676	176.529
BENEFITS/COSTS RATIO	0,17	0,27	0,48	0,37	0,48	0,58	0,69	0,80	0,90	1,00	1,12	1,22	1,32	1,43	1,57	1,06	1,12	1,19	1,25	1,56
I.R.R.				#NUM!	-26.5%	-17.1%	-10.4%	-5.6%	-2.4%	0.1%	2.2%	3.7%	4.9%	5.9%	6.9%	2.2%	3.6%	4.6%	5.4%	7.8%

## **M02.02 – Executive summary**

Nowadays Brescia public transport is mainly based on a bus fleet. No intermodality is provided. Almost the total number of bike city trips doesn't include other transport modes, resulting in a critical distance problem. Intermodality is used only for suburban trips involving only the train station and the main bus station obviously located in the same place. The consequence is a very congested area resulting in difficult and uncomfortable mode-shift.

The measure mainly consisted in research studies and demo activities finalized to the start-up of Brescia metro line in year 2013. The integration of two innovative systems: bike-sharing network, automated-metro line, train and bus services is one of the most innovative aspect.

The measure implementation consisted in the realization of different scenarios which aimed to reorganize PT network, in order to enlarge the positive effects of the new metro line. The macro-simulation activities produced new local PT scenarios, called K, B, B\* that were developed under two different hypothesis:

1. scenario K (radial line PT network), it has been characterized by bus lines serving the outskirts residential areas, short trips and terminus at the metro stations.
2. scenario B (diametric line PT network), it has been characterized by long bus lines to directly connect outskirts areas set at opposite sides of the city providing also possible interchanges with the metro line.

The scenario B\* – that has been the final chosen solution – was a refinement of the scenario B (intermediate scenario).

Economic indicators have been selected in order to monitor the new network organisation, while “Transport” indicators have been useful to evaluate scenarios from the view point of new local PT network efficiency. Finally, one indicator has been used to monitor potential intermodal user comfort.

The micro-simulation activities were focused on the public space quality just outside the metro stations. The model made evident that several road safety problems can occur to pedestrians at crossings – in particular for the ones located closed to roundabouts. A check list has been provided to evaluate the level of service of each foreseen PT stop. A good and safety position of PT stops has been considered fundamental also to attract new PT users.

The scenarios allowed also to simulate the integration between new local PT network and P&R service providing useful information about interchange parking size and the number of potential users to be attracted. Additionally, focusing on disabled user needs has been important to develop a high quality PT network.

The measure implementation has allowed to detect and describe a replicable methodological approach for the re-organization of local PT network in presence of an innovative means of transport, like the metro line.

## A. Introduction

### A1 Objectives

The measure objectives are:

(G) High level / longer term:

- To maximise the potential for local public transport through an accessible service that is a fast and convenient alternative to the private car and then promoting a less car dependant life-style.

(H) Strategic level:

- To develop and modernize the transport network planning new itineraries to reorganize traffic flows. To plan and integrated mobility system for the city of Brescia and in particular, as a medium term objective, to re-design the interchange system in order to favour the intermodality with the new Metro line (start up foreseen in Dec 2012).

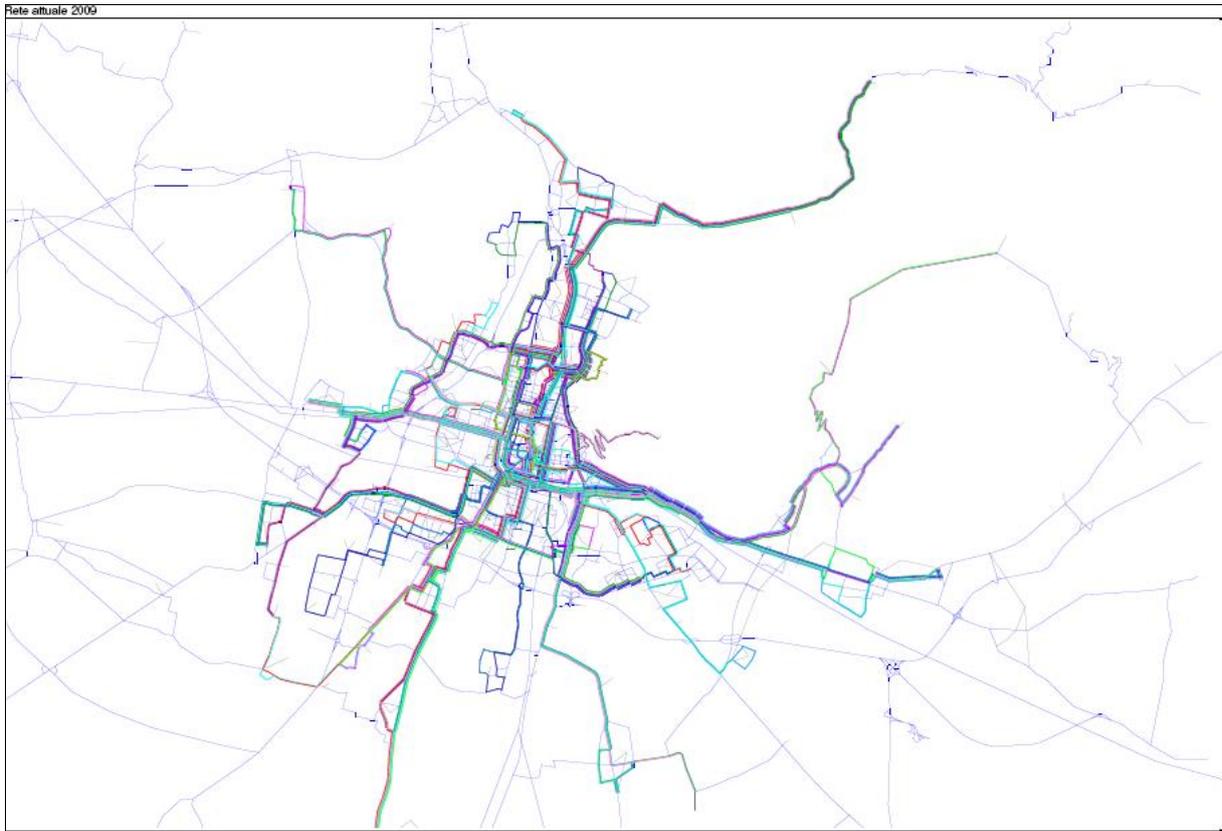
(I) Measure level:

- (1) To carry out research, feasibility studies and demo activities before the put into service of the new Metro line, in order to improve the transport system in Brescia by implementing an integrated mobility system, considering also the use of soft modes (e.g. the bike sharing network).
- (2) To investigate disabled people's need to move and the intermodal users comfort

### A2 Description

Metro line start up by 2013 will introduce a significant change in the PT system of the city. The introduction of such a new means of transport leads to an important revolution of the PT network, especially for urban busses. Only one Metro line will cross the city from South-East to North connecting S. Eufemia residential area to the University Pole passing through the railway station (i.e also suburban bus station) and through the historical city centre.. Different scenarios to reorganize PT network were analysed in order to avoid problems due to the local PT lines overlapping (for example line 1 – LAM - that crosses the city from North to South) and to enlarge the positive effects of the new metro line. The measure mainly consisted in research studies and demo activities, characterized by macro/micro simulations.

The first implemented scenario (the chosen one to represent the ex-ante state) simulated the organization of the urban and suburban bus network before the measure implementation, as shown in figure 1.



*Fig.1: Actual situation of the local PT characterized by the urban and suburban network (2009) (ex-ante scenario)*

Among the implemented scenarios (ex post), the presence of the new metro line was considered as a hypothesis for the new local PT network design.

The theoretical scenario considered as strategic nodes:

- the metro stations situated in the North,
- the metro station by the train station and
- the metro station at the South-East of the city.

After the metro start up commuters will have at their disposal two interchange areas (Park and Ride):

- one in the Northern part of the city (Casazza/Prealpino);
- the other in the South-East part (S. Eufemia/Poliambulanza).

Commuters coming from the West side (Milan direction), usually, use the train, and the railway station is one of the Metrobus stops.

Furthermore the railway station area is the terminus of all the extra-urban buses of the city.

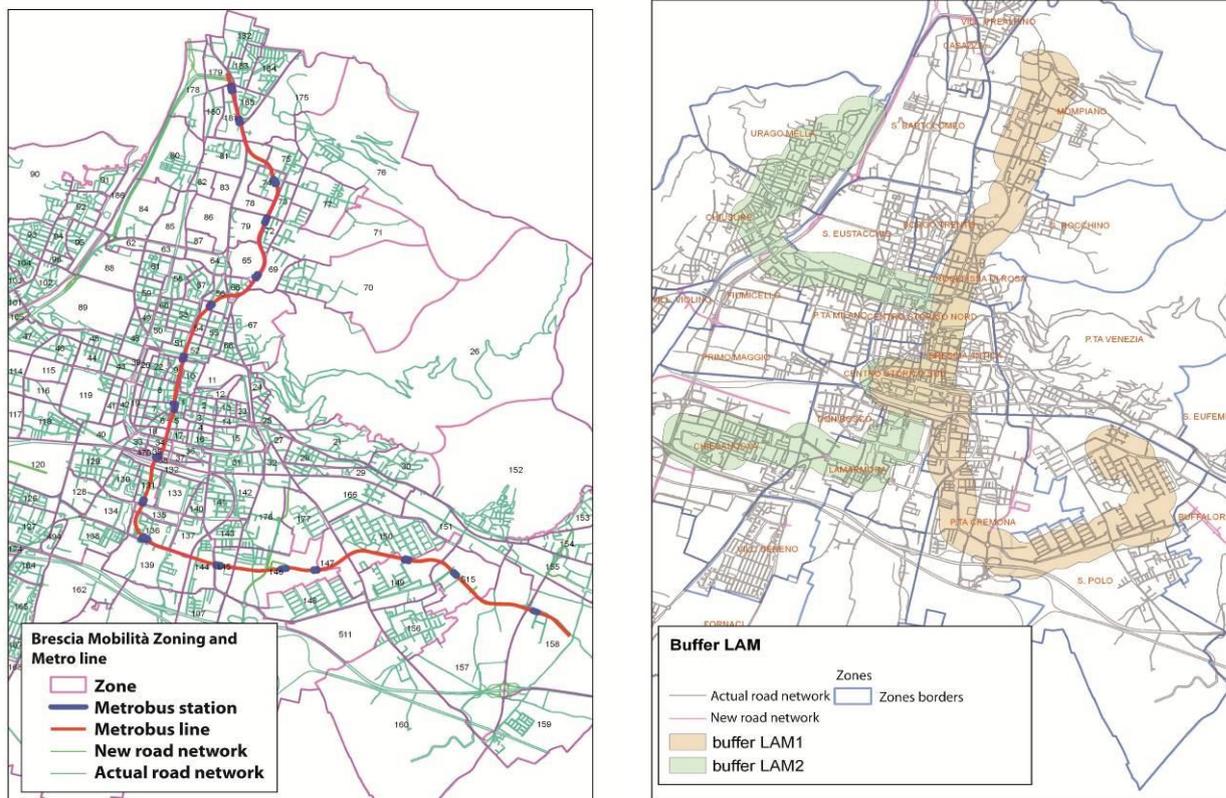


Fig.2-3: On the left, the new zoning of the city of Brescia used to build up different scenarios; on the right, the planned situation of the local PT characterized by the urban and suburban network

The project of the new local PT system was based on several assumptions; the main ones have been reported below

- Metro line first functional stretch S. Eufemia – Prealpino Village;
- location of potential residual users;
- local PT journeys duration in relation to the relevant zones of the cities;
- staging post of suburban busses from Val Trompia at Prealpino metro station (North terminus);
- staging post of suburban busses at S. Eufemia metro station (East terminus);
- new local PT network foresees the interchange with Metrobus for each bus line;
- the bus routes converge on metro stations, avoiding – when possible – overlapping of the service, trough new routes and new terminus ;
- maintaining of current suburban bus lines for school service in order to strengthen the connection of the station with schools.

Each scenario derived from the previous one and it is characterized by a more in-depth study (see Annex 4 for more technical details).

Besides, thanks to the integration between the new metro line and the PT (urban and suburban) system, the use of bicycle in particular bike-sharing (bike-sharing stations will be located just outside the metro station) should represent an opportunity to develop integrated sustainable mobility. Bikes will be also allowed on board the Metrobus.

## B. Measure implementation

### B1 Innovative aspects

- New conceptual approach
- New policy instrument

The innovative aspects of the measure are:

- **Innovative aspect 1 (New conceptual approach)** –In order to study the best solution for the PT network joined to the new metro line, a simulation software was used. The innovative approach consists in the use of different modelling techniques (macro and micro) and in the idea of creating an integrated fares system among the different means of transport.
- **Innovative aspect 2 (New policy instrument)** –The modelling techniques represent an important tool to make strategic choices about the future PT network.

### B2 Research and Technology Development

Macro simulations have been carried out through the use of the software called “CUBE” and average traffic flows coming from O/D matrix have been taken into consideration. Data source are mainly two: traffic data (referred to the peak hour of the morning 7:30-8:30) come from the loop detectors located on some roads of the city; information about the origins and destinations of the trips comes from ISTAT census (the most recent available census is dated 2001). The choice to consider the peak hour of the morning comes from the following considerations: first of all, in the morning road traffic is considered systematic, therefore it’s easier to simulate: in the evening, traffic is more difficult to be modelled, because it requires specific surveys about the origin/destination of the trip. Recent data are not available at the moment. Moreover, the morning peak hour is also critical from the PT service point of view, because of the students mobility needs. Macro simulation isn’t based on the research of the shortest trip to be covered (obtained by a single iteration process), but through several iterative steps, which bring to the equilibrium of the simulated network. This kind of simulation allows a reliable modelling of the morning peak hour situation. The new hypothetical network was based on a set of bonds and assignment. The load profile of every line of the new public transport network was the model output, also including the metro line and a lot of skim matrices, which described many parameters about the behaviour of the net (i.e. on-board time, walk-time, wait-time, distance of the trips).

Besides this simulation technique, another one, proposed in the past by some British consultants (Steer Davies Gleave), has been used to compare the simulated results. The present network and the simulated one have been treated using different modelling techniques (CUBE and SDG) and these two different approaches have led to the same results.

In order to better understand the integration of the metro stations with the bus lines, also micro simulation techniques have been used in specific places (“Prealpino” and “General Hospital” metro stations). Two different software are available: Paramics and CUBE Dinasm. Although similar, the former doesn’t consider the pedestrian movements and shows a more “pessimistic” situation, the latter is more accurate from the pedestrian needs point of view.

**B Situation before CIVITAS**

Brescia public transport was mainly based on a bus fleet. No intermodality was in place. For example, almost the total number of bike city trips didn't include other transport modes. Intermodality was implemented only for suburban and extra-urban trips, involving just the train station and the main bus station, both located in the same congested area, in the southern part of the historical centre. Besides, there wasn't a common ticketing system among the PT operators. Therefore, Civitas project made it possible to study the new local PT transport network more in-depth. The bus network had to be integrated with the new metro line and other mobility services available (e.g. bike sharing).

**B4 Actual implementation of the measure**

In this measure the following stages were implemented:

- **Stage 1: Design of new public transport network and Brescia intermodal scheme** (from February 2009 to December 2010) – This stage defined the assumptions beyond the scenario in order to simulate it through the use of a model software (stage 3).

*This stage was the most important one because it involved all the stakeholders – in particular CBS, BST and BSM - for the strategic choices concerning the PT mobility (see chapter A1 of this format). As a matter of fact the new assessment of the PT network represents the future for the city.*

*A first hypothesis of network was discussed in order to decide if it was the one to be implemented or not. This depended on the political and technical choices made by CBS, BST and BSM:*

*Due to this discussion among the stakeholders the measure experienced some delays, there was evidence of the strategic impact of such kind of choice not only for the city but also for all the metropolitan area.*

**Stage 2: Metro station intermodal analysis** (from February 2009 to February 2011) – This stage consisted in the collection of the information about the Metro Stations and in the micro simulation of that specific location using a model based on SIAS-Paramics software. The simulation made evident that several road safety problems could occur in relation to pedestrians at crossings (in particular for those set near roundabouts) during interchanging actions.

*In particular, it was necessary to study the more suitable place for the new local PT stops, not only considering the interchange possibility with the metro line, but also the characteristics of the present services and infrastructures (e.g. the design of the pedestrian crossings, of their location, of their overall dimensions, etc.).*

*It was possible to study the problem through the realization of a check list, useful to evaluate the level of service of each foreseen local PT stop. A good location and safety in local PT stops is considered fundamental also to attract potential users.*

*Two examples of the actual implementation of public space re-design near the metro station are shown in images.n4-5.*

*The first example regards the “Prealpino” metro station. Next to the metro station there will be the interchange parking area and just outside the station there is a commercial area with shops, bars, supermarkets, etc. The road leading to the station is the main connection to the Northern part of the territory and therefore it has a heavy traffic load. To reach the station from the Prealpino Village - that is a neighbourhood with about 1.000 inhabitants – pedestrians have to cross the road.*

*Due to the micro-simulation done this area was redesigned to favour pedestrian safety.*

*Crossing next to the roundabout was equipped with protection railings, and it was staggered to make the pedestrian route from the metro station shorter. Also the other pedestrian crossings were equipped in order to make them safer.*

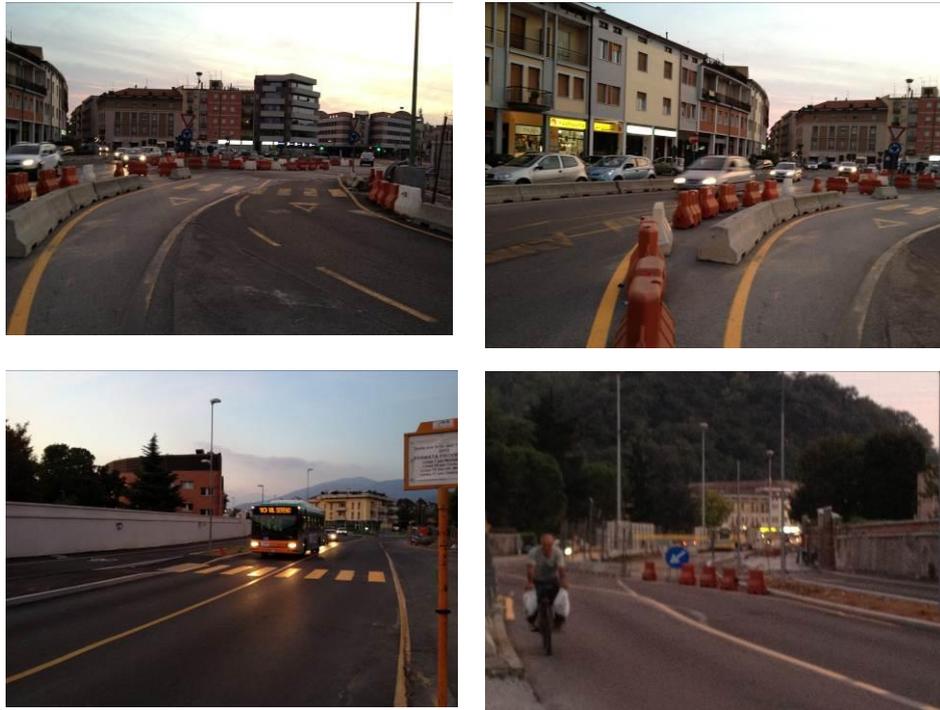


*Fig.4: Example of “Prealpino” metro station pedestrian crossings*

*The last example regards the pedestrian crossing near the “Ospedale” metro station (General Hospital). It’s important to highlight that this structure is characterized by wide pedestrian stream and the public space re-design was considered fundamental to give a better service to pedestrian and to increase the interchange local PT-metro. Even if the metro start up is foreseen by 2013, it was possible to organize and simulate the pedestrian stream, in order to study the safety of the public space.*

*Due to the significant traffic flow in the General Hospital area micro-simulation made evident the conflicts between the Vulnerable Road Users and the vehicles. In fact several services and shops are set facing the hospital (i.e. in front of the metro station). The road to be crossed is one of the main roads in the city, furthermore the hospital metro station serves also a number of secondary schools. Students need to cross the road to reach their schools and besides it is foreseen to reorganise the bus stops in the same area. (many bus stops of urban and suburban lines are located in the hospital area at the moment).*

*As a consequence of the simulation results it was decided to re-design the intersection, but due to its particular geometry in loco experimentation was needed(see fig. 5). At the moment the intersection has been partially re-designed using temporary solutions. As the roads that form the intersection are also the preference rout to reach the emergency unit from the southern part of the city the assessed solution will be possible only after several experimentations and probably only after the start-up of the metro; as only then it will be possible to see real traffic flow both of pedestrians and vehicles.*



*Fig.5 : Example of “Ospedale” metro station: reorganisation of the pedestrian paths and intersection*

- **Stage 3: Design of the new public transport network, simulation of the network** (from October 2008 to April 2012) – This stage consisted in the macro simulation of the existing network and of the new PT network scenarios using the assumptions chosen during stage 1. The first scenario (Scenario K) was the one used to build the Business as Usual. The main scenario was developed in July 2011 (scenario B) and it was taken as reference for the on-going data collection. The latest scenario consisted in the refinement of the main one and it was done in May 2012 (Scenario B\*).

During this stage the scenarios related to the new PT network starting from the same assumptions, were developed as following:

- Radial line PT network (Scenario K)
- Diametric line PT network (Scenario B – B\*)

Radial line PT network (Scenario K) – fig. 6: it was characterized by bus lines that served the outskirts residential areas, short trips and terminus at the metro stations.

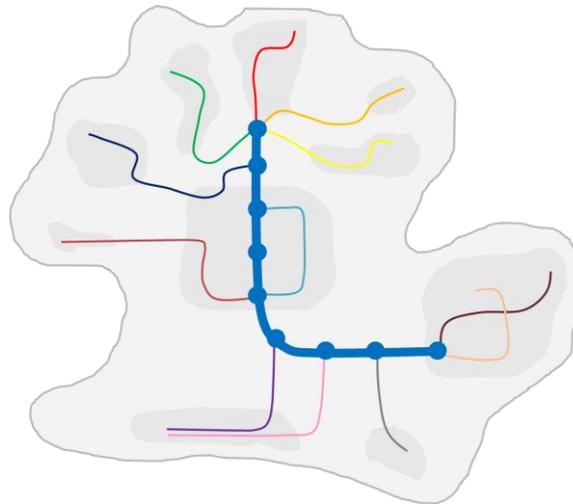


Fig. 6- Radial line PT network (Scenario K):

Diametric line PT network (Scenario B) - fig. 7: it was characterized by long bus lines to directly connect outskirts areas set at opposite sides of the city providing also possible interchanges with the metro line. This led to an optimization of the connections in the historical centre. .

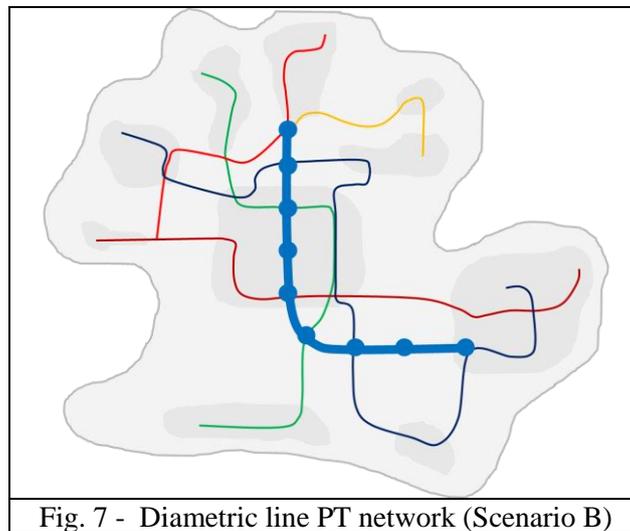


Fig. 7 - Diametric line PT network (Scenario B)

- In May 2012, a new scenario named "B\*" (fig. 8) was developed. It represented a refining step of Scenario B. It was preceded by a deeper study on rates, terminus relations, runs and through passing busses in neighbourhoods starting from the hypothesis considered during the simulation of the network (Scenario B),

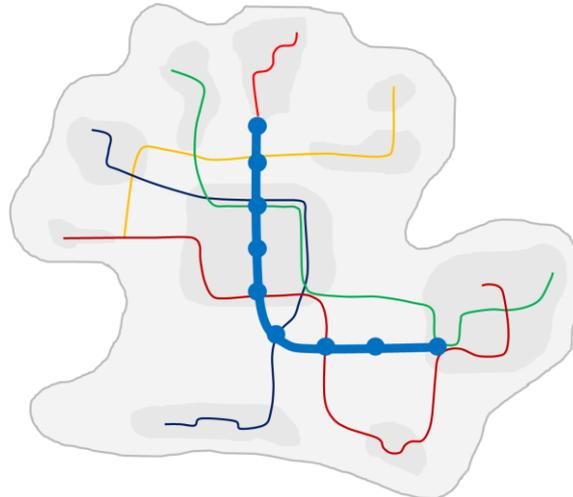


Fig. 8 - Diametric line PT network (Scenario B\*)

In order to complete macro and micro simulation activities network accessibility problems for disabled users were investigated. Brescia already has a dedicated on demand service (called Accabus) for disabled people with about 16.000 passengers/year and in time it has ensured accessibility to the main bus lines in the city.

The more frequent and accessible bus routes -1, 2 and 3- can be considered a good starting point for making the local public transport network "accessible" without damaging the high quality standards that characterize them, indeed increasing quality.

As regards accessibility to a means of public transport, the Metrobus, conceived as a light rail system, offers high quality solutions where the usability of the vehicle is provided to everyone.

Specifically, the Metrobus project in Brescia requires full access, which means the best solution for three problems: access to the station, access to the vehicle and a reserved space for the disabled person on-board the vehicle.

The Metrobus does not simply remove physical barriers, but it also does away with mental barriers, i.e. those barriers that even nowadays permit the construction of new buildings with back doors (sometimes hidden) to be used by the disabled.

## **B5 Inter-relationships with other measures**

The measure has potential interactions with the other measures proposed in Brescia, using Civitas plus funding, to study the new public transport asset after metro realization.

The real effects of the implementation of these measures will be seen only after the start-up of the Metrobus.

The “Metro package” groups the following measures:

- M.02.03 “Development and upgrade of the e-ticketing system”;
- M.03.03 “P&R facilities for underground and public transport system”;
- M.08.05 “Brescia Mobility Channel”.

**C.**

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## C Evaluation – methodology and results

### C1 Measurement methodology

As general methodological assumption, the EX ANTE situation refers to the simulation model built to represent the existing network (which is characterized by the bus network without the metro line).

The EX POST situation refers to the simulation of new PT network scenarios that include bus network and the metro line.

The indicators have been divided into two macro categories: main indicators and complementary indicators.

Main indicators evaluate the measure’s efficiency in terms of objectives achievement. In addition a complementary indicator was introduced to investigate user comfort.

In the following table the indicators classified as “complementary” and the ones that have been deleted because no more significant due to some changes in measure scope has been specified.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Economy	Ratio between km of simulated lines by type of PT and km of existing lines by type of PT	Simulated network data in respect to the existing network data.	Main Indicator
2	Economy	Ratio between km per line and total km of PT	Extension of each bus line and total extension of the network, existing and simulated.	Main Indicator
3	Traffic level	Traffic Flow peak/off-peak	Real traffic data from the detectors	No more collected, and substituted by 3.1
3.1	Traffic level	Simulated Traffic Flow in the peak hour	Simulated private traffic flows in 2 significant road sections in the peak hour	Complementary Indicator
4	Modal split	Average Modal Split	Repartition between the public and the private mobility demand (simulations)	Main Indicator
5	Transport	Number of overlapping lines per link	Number of overlapping lines on a road segment (link) composing the road network	Main Indicator
6	Transport	Number of interchanges per km per trip	Number of modal interchanges per km of trip on the local PT network (both urban and suburban)	Main Indicator
7	Transport	Ratio between the number of simulated passenger and the number of passengers transported	Ratio between the simulated passengers of the peak hour and total ones per day.	Main Indicator
8	Users	Intermodal User	Data coming from the Customer	Complementary indicator

Measure title: **INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

	comfort	Comfort	Satisfaction questionnaires.	
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Detailed description of the indicator methodologies:

- **Indicator 1** (*Ratio between km of simulated lines by type of PT and km of existing lines by type of PT*) – This indicator is expressed by the ratio between the simulated PT network extension and the existing network.
- **Indicator 2** (*Ratio between km per line and total km of PT*) – For each line the length of the itineraries has been reported and the percentage (respect to the total) has been calculated, in order to know how weigh of each line respect to the total PT network.
- **Indicator 3** (*Traffic Flow peak/off-peak*) –Using the data collected by the detector loops the actual traffic flows are monitored for 2 significant road sections. INDICATOR NO MORE COLLECTED, and substituted by Indicator 3.1
- **Indicator 3.1** (*Simulated Traffic Flow in the peak hour*) – For each simulation model considered, the simulated private traffic of the peak hour is calculated, for two significant road sections.
- **Indicator 4** (*Average modal split*) – It is expressed as the repartition between the public and the private mobility demand as they can be extracted by the simulation models.
- **Indicator 5** (*Number of overlapping lines per link*) – This indicator expresses the number of overlapping bus lines on the road segments (links) that compose the road network of Brescia and the served metropolitan area (14 neighbouring municipalities).
- **Indicator 6** (*Number of interchanges per km per trip*) – This indicator expresses the number of interchanges per km of trip made using the public transport (both urban and suburban lines). The model, according to the O/D matrix of the PT, identifies which lines are used to move form Origin to Destination and the number of interchanges needed to reach the destination.
- **Indicator 7** (*Ratio between the number of simulated passenger and the number of passengers transported*) – This indicator is expressed by the ratio between the simulated passengers of the peak hour and total passengers simulated per day.
- **Indicator 8** (*Intermodal User Comfort*) – This indicator is based on the real judgements expressed by the citizens about the public transport service, in occasion of the customer satisfaction customer survey, regularly made by Brescia Trasporti. This indicator has been set as complementary, because it gives an estimation of the perceived quality of service by the PT users. The indicator can be estimated up to 2013 (start-up of the metro) projecting the historical data series available

## C1.2 Establishing a Baseline

The Brescia Mobilità SpA company (metropolitan mobility company) for years aimed at improving the local PT service also in terms of planning the changes to the bus network. The company, in order to identify the best local PT network scenarios, before translating them into reality, a software for the elaboration of simulation models has always been used.

Main indicators selected for this measure monitored simulated scenarios. They were referred to the existing network (ex-ante), to the new network scenarios K, (B on going scenario), B\*- that had to be designed during Civitas - that simulated the scene after the metro start up.

The objective of the evaluation was to investigate, through the selected indicators, the performances of the simulated networks in terms of:

- extension accuracy (ind. 1 “Ratio between km of simulated lines by type of PT and km of existing lines by type of PT”),

- weigh of each simulated bus line respect to the total network (ind. 2 “Ratio between km per line and total km of PT”),
- consequences on the simulated private traffic flows (ind. 3.1 “Simulated Traffic Flow in the peak hour”),
- simulated subdivision between public transport and private mobility demand (ind. 4 “Average modal split”),
- number of overlapping lines on single road segments (ind. 5 “Number of overlapping lines per link”),
- simulated bus interchanges on the PT lines (ind. 6 “Number of interchanges per km per trip”),
- number of simulated passengers that move during the peak hour respect the total number of simulated passenger per day (ind. 7 “Ratio between the number of simulated passenger and the number of passengers transported”).

Also the perceived quality of the PT service (ind. 8. “Intermodal user comfort”) was taken into consideration projecting historical data series.

The baseline situation of the selected indicators consisted in the simulation model of the existing network (urban and suburban lines), which was chosen as reference for the ex ante data collection. The time reference for the baseline is year 2009. As regards this network, the assessable number of busses in the peak hour is 140 and the total length of the network is about 1003 km.

Regarding indicator n. 3 (Traffic Flow peak/off-peak), initially selected to monitor the consequences on the actual private traffic flows, it was removed from the original list of indicators, as it was decided to substitute it with indicator 3.1 (“Simulated Traffic Flow in the peak hour”) that evaluated the repercussions of the new network scenarios on the private traffic, using the data coming from the simulation models.

For indicator 5 (Number of overlapping lines per link) the baseline was expressed by the number of overlapping bus lines on the road segments (links) that compose both the road network of Brescia and the served metropolitan area (14 neighbouring municipalities).

The indicator was expressed under the shape of a histogram (fig. 9), which can be synthesized by two values: the first one was expressed by the number of road links overlapped by the total number of lines composing the network; the second one was expressed by the maximum number of links covered by one single line.

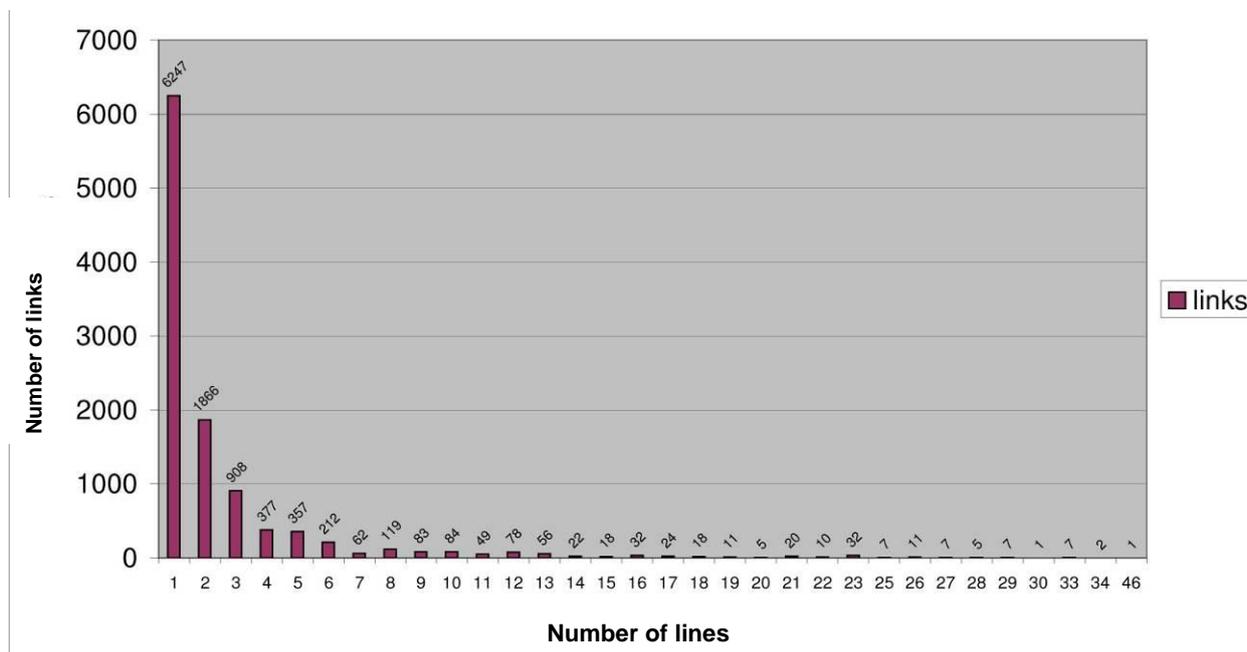


Fig.9: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

Indicators	Baseline (existing network simulation - 2009)
1. Ratio between km of simulated lines by type of PT and km of existing lines by type of PT	Ratio for the urban lines= 1 Ratio for the extra-urban lines = 1
2. Ratio between km per line and total km of PT	(Here are reported only the minimum, maximum and average values. The complete table can be found in the section dedicated to the collection of the indicators) min value = 0,26% max value = 2,45% average value = 1,45%
3.1. Simulated Traffic Flow in the peak hour	Detector n. 26 “Via da Vinci”: Simulated transit = 1703 Detector n. 42 “Via Oberdan”: Simulated transit = 1369
4. Average modal split	Private transport: 85.5% Public transport: 14.5%
5. Number of overlapping lines per link	1 link overlapped by 46 lines; 6.247 links covered by 1 single line
6. Number of interchanges per km per trip	0.318
7. Ratio between the number of simulated passenger and the number of passengers transported	29% of the daily passengers travels during the peak hour (190 equivalent days per year)
8. Intermodal User Comfort	7,35 / 10 (actual results of the standard customer satisfaction survey made in November 2009)

Tab.1: Indicators baseline

### **C1.3 Building the Business-as-Usual scenario**

As general assumption for the BaU building, certainly within 2012 (before the start-up of the metro) a testing scenario (called Scenario “K”) would have been elaborated, in order to provide a scenario to be taken as reference for the competitive tender concerning the new TPL definition integrated with the metro line. The objective of this measure was to provide more and more refined scenarios for the selection of the network that would be implemented after the start-up of the metro. Therefore, likely, without Civitas, only one testing scenario would have been simulated. This scenario has been taken as reference for the BaU situation.

In order to better understand, it must be underlined that the Metro would have been built in any case with the start-up foreseen by 2013. The simulation used for the BaU scenario uses data projected up to 2013 (indicators from ind. 1 to ind. 6). The BaU scenario is based on the start-up of the Metrobus from the metro depot in S. Eufemia (Via Serenissima) to its terminus in Prealpino Village.

This scenario of the new local PT system was planned to adapt the bus transport networks (urban-suburban) to the metro line according to the following hypothesis:

- Metro line first functional stretch S. Eufemia – Prealpino Village;
- dislocation of potential residual users;
- staging post of suburban busses lines from Val Trompia at Prealpino metro station;
- staging post of suburban busses lines at S. Eufemia metro station
- staging post of remaining suburban busses lines at South and North terminal at the station and at metro station;
- realization of suburban bus stops next to the metro stations, if they haven’t staging post;
- use of existing fast-tracks without high speed bus lines (LAMs);
- each bus line should allow interchange with metrobus;
- reduction of bus lines through the city centre;
- high reduction of bus lines length;
- possibility of passenger-interchanging next to metro stations;
- maintaining of current suburban bus lines for school service, with modification/integration;

The obtained local PT bus network was subdivided into urban and suburban lines:

- urban direct lines (direct connection among suburban quarters, not served by the metro line);
- suburban lines to metrobus (direct connection of suburban lines, from the metropolitan area, to the nearest metro station);
- urban suburban lines (bus connection of suburban quarters not passing through the city centre, with at least one connection to a metro station);
- new bus line with 8 m long vehicles passing by the station hub, Freccia Rossa shopping centre, the city centre and the new residential area “Comparto Milano”.

Indicator 5 (Number of overlapping lines per link) expresses the number of overlapping bus lines on the road segments (links) that compose the scenario road network of Brescia and the served metropolitan area (14 neighbouring municipalities). It is given under the shape of a histogram, (see fig. 10) and it can be synthesized by two values: the first one is expressed by the number of road links overlapped by the total number of lines composing the network; the second one is expressed by the maximum number of links covered by one single line.

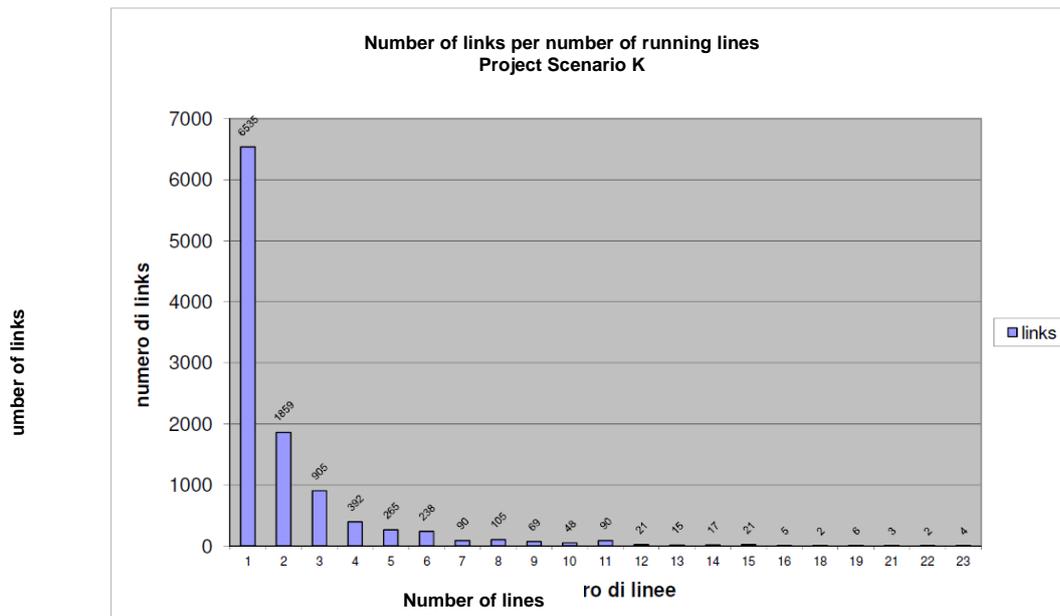


Fig.10: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

Indicator 7 (Ratio between the number of simulated passenger and the number of passengers transported) is the same for BaU and Baseline (without the metro line), in order to evaluate equally the projection of the number of passengers per year, starting from the number of transported passenger per hour and direction. It's a precautionary setting, because at the moment it isn't possible to establish if the new public transport network will lead a significant variation in the perception of the transport system with the metro. In principle, it's expected a more predisposition to the public transport use in off-peak hours, during all the day, not only earlier in the morning. Therefore the peak hour influence on the rest of the day will reduce and determine an increase of passengers per day (and passengers per year). As regard indicator 8 (Intermodal user comfort), the BaU scenario is built projecting the indicator up to November 2013 (when the metro line will be active) using historical data up to 2013.

Indicators	BaU = testing scenario - 2013
1. Ratio between km of simulated lines by type of PT and km of existing lines by type of PT	Ratio for the urban lines= 0,68 Ratio for the extra-urban lines = 0,95
2. Ratio between km per line and total km of PT	min value = 0,46% max value = 3,11% average value = 1,72%
3.1. Simulated Traffic Flow in the peak hour	Detector n. 26 "Via da Vinci": Simulated transit = 1712 Detector n. 42 "Via Oberdan": Simulated transit = 1228
4. Average modal split	Private transport: 74.1% Public transport: 25.9%
5. Number of overlapping lines per link	4 links overlapped by 23 lines; 6.535 links covered by 1 single line
6. Number of interchanges per km per trip	0,357
7. Ratio between the number of simulated passenger and the number of passengers transported	29% of the daily passengers travels during the peak hour (190 equivalent days per year)

8. Intermodal User Comfort	7,58 / 10  (Projections of the indicator up to November 2013 when the metro line will be active using historical data up to November 2009 - baseline)
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Tab.2: Indicators BaU

## C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – economy, society and transport. The data collected as "after situation" are referred to the "Scenario B\*", while the ones as "BaU" are referred to the "Testing Scenario K".

### C2.1 Economy

**Table C2.1.1: Measure results for the indicators of the category “Economy”**

Indicator	Before (existing network simulation)	After (timeline: 2013)	B-a-U (timeline: 2013)	Difference: After – Before	Difference: After – BaU
1) Ratio between km of simulated lines by type of PT and km of existing lines by type of PT	Ratio for the urban lines= 1	Ratio for the urban lines= 0.88	Ratio for the urban lines= 0.54	- 0.12	- 0.34
	Ratio for the suburban lines = 1	Ratio for the suburban lines = 0.91	Ratio for the suburban lines = 0.91	- 0.09	0
2) Ratio between km per line and total km of PT (See the complete table reported in the detailed description of the indicator. Here you can find the minimum, maximum and average values)	min value = 0,26%	min value = 0,29%	min value = 0,46%	+0,03	+0,17
	max value = 2,45%	max value = 2,79%	max value = 3,11%	+0,34	-0,38
	average value = 1,45%	average value = 1,61%	average value = 1,72%	+0,16%	-0,11

Indicator 1 “Ratio between km of simulated lines by type of PT and km of existing lines by type of PT”, evaluates the new PT network (scenario) in relation to the existing one in terms of reduction of PT length (kms).

The new PT network is shorter: there is a reduction of kilometres in bus lines routes (both in urban and suburban lines), Line 1 was completely replaced by the metro line in both the scenarios.

The differences between the "K Scenario" (BaU) " and the B\* Scenario" (after situation) were affected by the different hypothesis:

- "K Scenario" (radial) - the lines were shorter with a terminus at metro-station, with a minimum overlapping with the new metro line.
- B\* scenario (diametral) - the lines were longer, well connecting suburban areas, overlapping the metro line when necessary.

Indicator 2 "Ratio between km per line and total km of PT" measures the length of each bus line respect to the total length of the PT network (existing or simulated). According to the "scenario B\*" the "weight" of the single bus line grew in relation to the simulated network, as the foreseen network was shorter than the existing one.

## C2.2 Energy

No indicators were foreseen within the category "Energy"

## C2.3 Environment

No indicators were foreseen within the category "Environment"

## C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category "Transport"**

Indicator	Before (existing network simulation)	After (timeline: 2013)	B-a-U (timeline: 2013)	Difference: After –Before	Difference: After – B-a-U
3.1. Simulated Traffic Flow in the peak hour	Detector n. 26 "Via da Vinci": Simulated transit = 1703	Detector n. 26 "Via da Vinci": Simulated transit = 1712	Detector n. 26 "Via da Vinci": Simulated transit = 1712	+ 9	0
	Detector n. 42 "Via Oberdan": Simulated transit = 1369	Detector n. 42 "Via Oberdan": Simulated transit = 1228	Detector n. 42 "Via Oberdan": Simulated transit = 1228	-141	0
4. Average modal split	Private transport: 85.5%	Private transport: 74.1%	Private transport: 74.1%	- 11.4	0
	Public transport: 14.5%	Public transport: 25.9%	Public transport: 25.9%	+ 11.4	0
5. Number of overlapping lines per link	1 link overlapped by 46 lines	1 link overlapped by 28 lines	4 links overlapped by 23 lines	1 link overlapped by 28 lines VS 1 link overlapped by 46 lines =the number of lines seems to be optimised.	1 link overlapped by 28 lines VS 4 links overlapped by 23 lines = the number of lines is higher with a
	6.247 links covered by 1 single line	6.267 links covered by 1 single line	6.535 links covered by 1 single line		

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Indicator	Before (existing network simulation)	After (timeline: 2013)	B-a-U (timeline: 2013)	Difference: After –Before	Difference: After – B-a-U
					reduction of terminus.
6. Number of interchanges per km per trip	0.318	0.346	0.357	+ 0.011	- 0.011
7. Ratio between the number of simulated passengers and the number of passengers transported	29% of the daily passengers travels during the peak hour (190 equivalent days per year)	29% of the daily passengers travels during the peak hour	29% of the daily passengers travels during the peak hour	0	0

As regards the indicator 3.1 “simulated traffic flow in the peak hour” a reduction of vehicles was foreseen in all the developed scenarios, as they considered the metro line in existence, respect to the data collected using the simulation of the existing network (i.e. simulation related to the situation before the metro service implementation)..

The “scenario K” and the “scenario B\*” have the same value as they are both based on the metro line existence, therefore after and BaU indicators are the same in the indicator 3.1 “Simulated Traffic Flow in the peak hour” and in the indicator 4 “Average modal split” (that from the modelling point of view is the ratio between the local PT matrix and the private mobility one).

It has to be underlined that local PT network of the latter scenario ensured a better local PT service on the territory, as it is the refinement of a previous scenario, called “scenario B” (that was already based on mature assumptions in relation to the new local PT network). The “scenario B\*” could also favour the modal shift from the private transport to the public one, probably involving a bigger private traffic flow reduction than the assumed one: Indicator 4 “Average modal split”.

As regards the indicator 5 “Number of overlapping lines per link”, the value collected with the “Scenario B\*” is higher than the one collected with the Testing “Scenario K” (as shown in figure 11). It’s important to highlight that the overlapping value of “Scenario K” seems to be too low if considering the overall network efficiency (both urban and extra-urban networks).

Furthermore the “B\* scenario” assumed as an upgrading action an overlapping with the metro line (Indicator 5. Number of overlapping lines per link) in order to provide diametric bus lines that directly connect the Eastern and Western parts of the city (see fig, 11-12-13).

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

Measure title:

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

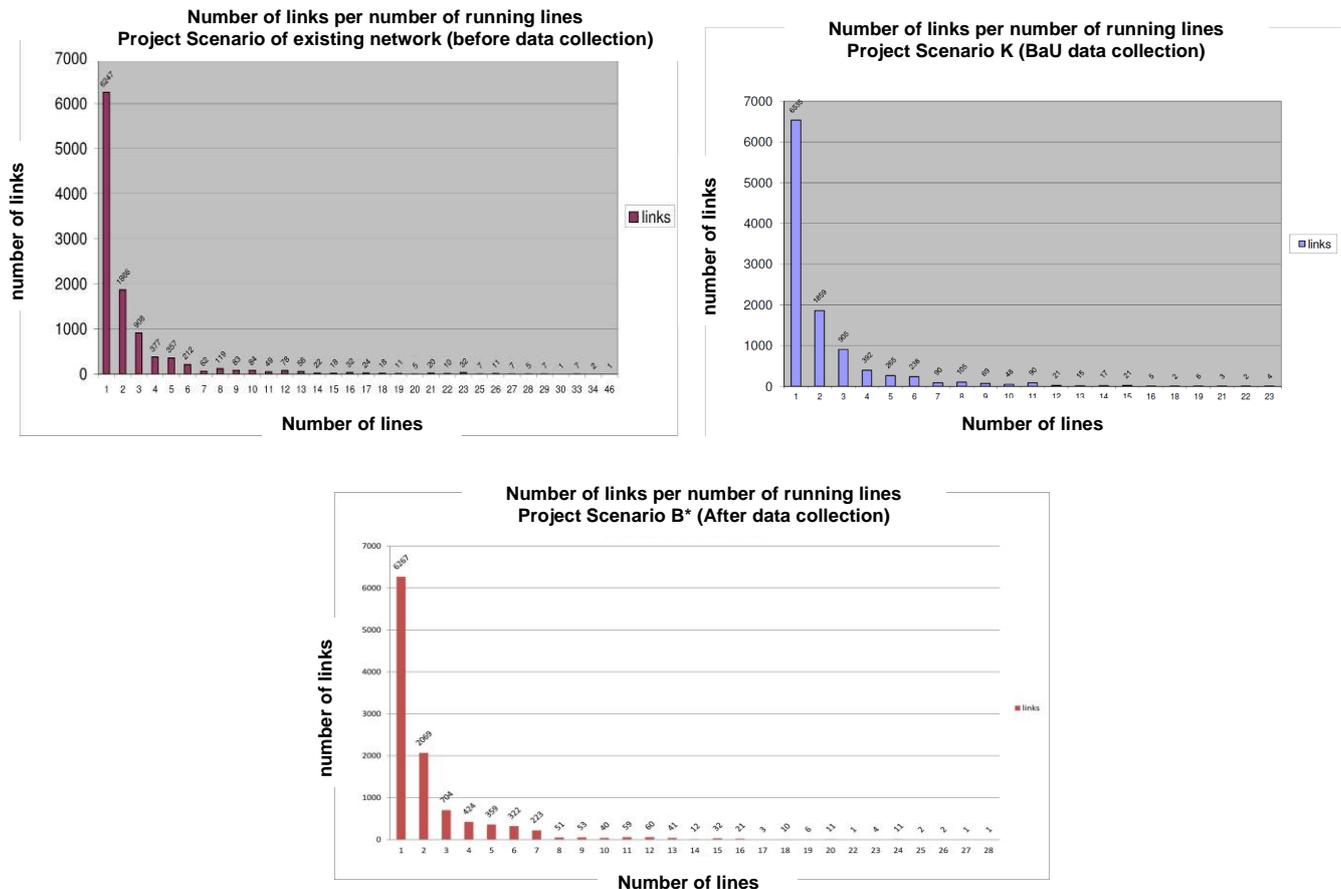


Fig.11-12-13: Comparison of number of overlapping PT lines on each road segment (links)

This topic can be interpreted also in the light of the indicator 6 “Number of interchanges per km per trip”: the K, B\* scenarios, with respect to the actual network, reduced the total trip duration increasing the number of modal interchanges.

The number of interchanges foreseen in “Scenario K” was too high (as a "radial" organization of the bus lines was foreseen in the PT network using the metro line – that crosses the city from South-East to north – as the main line of the PT network itself).

On the contrary, in the “Scenario B\*” the value of this indicator was lower as it represents a decrease in modal breakings during the users movements (as a consequence of the "diametric" organization of the bus lines, that directly connect the Eastern and Western parts of the city).

The indicator 7 “Ratio between the number of simulated passengers and the number of passengers transported”, is assumed the same as it will take time to get to the metro’s full performance and consequent impact on its users. As a matter of fact the metro would likely increase this value.

## C2.5 Society

Table C2.5.1: Measure results for the indicators of the category “Society”

Indicator	Before (existing network – November 2009)	After	B-a-U (timeline: 2013)	Difference: After – Before	Difference: After – B-a-U

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Indicator	Before (existing network – November 2009)	After	B-a-U (timeline: 2013)	Difference: After – Before	Difference: After – B-a-U
8. Intermodal User Comfort	7,35 / 10	7,58 / 10 (Projections of the indicator up to November 2013 when the metro line will be active using historical data up to May 2012)	7,58 / 10 (Projections of the indicator up to November 2013 when the metro line will be active using historical data up to November 2009)	+ 0,23	0

Complementary Indicator 8 “Intermodal user comfort” was estimated using historical data series on “Users comfort” deriving from BST customers surveys and projecting them to the start-up of the metro.

BAU and After indicators weren’t assumed to be the same, as a matter of fact they are the result of different projection. This underline the slight influence deriving from the actions recently carried out by BST in relation to intermodal users comfort, that are mainly related to the start-up of the metro.

When the metrobus and the new network will be fully performed this value will probably increase, because it will benefit of all the actions implemented for the whole “Metro package” during Civitas (such as: Park and Ride, Brescia Mobile channel, e-ticketing, etc.).

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>To carry out research, feasibility studies and demo activities before the start-up of the new Metro line foreseen by 2013.</p> <p>This objective can be considered achieved in full.</p> <p>Besides the simulation model referred to the existing PT network, 3 network scenarios including the metro line have been developed.</p> <p>These scenarios (macro and micro simulations) called K, B, B* are based on an integrated mobility system, considering also the use of soft modes (e.g. the bike sharing network). Furthermore, disabled people’s needs to move and the intermodal users comfort have been investigated during the scenarios implementation.</p>	<b>**</b>
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full    *** = Exceeded</b></p>		

## **C4 Up-scaling of results**

This measure cannot be up-scaled, as it is already referred to the whole PT network.

## **C5 Appraisal of evaluation approach**

The evaluation activities consisted in the collection of the necessary data to calculate the selected indicators for the ex-ante/ex post situation in order to assess the achievement of measure objectives. Most part of the indicators deal with transport parameters and can be extracted by the simulation process. The ex-ante situation was referred to the existing PT network, the on-going data collection was made referring to a significant intermediate network scenario (called scenario B) and the ex post data collection was referred to the final PT network scheme agreed for the city (called scenario B\*).

The chosen set of indicators was subdivided into three categories: “Economy”, “Transport” and “Society” (for more details about indicators reported below, see the descriptions in section C1.1).

In the first group, indicator 1 (Ratio between km of simulated lines by type of PT and km of existing lines by type of PT) and indicator 2 (Ratio between km per line and total km of PT) were selected in order to monitor the new network organisation also from an economic point of view.

The group “Transport” contains indicator 4 (Average modal split), indicator 5 (Number of overlapping lines per link), indicator 6 (Number of interchanges per km per trip), indicator 7 (Ratio between the number of simulated passenger and the number of passengers transported), which were useful to evaluate scenarios as regards the organization of the new local PT network efficiency.

Complementary indicator 3.1 “Simulated Traffic Flow in the peak hour” (that substituted in 3 “Traffic Flow peak/off-peak”) collected using the peak hour traffic flows in 2 significant road sections of roads accessing the city was useful to better understand new PT system efficiency and the new PT network potentialities in improving sustainable modal split.

Indicators related to the Transport category were chosen in order to underline interchanges with other local PT systems (direction East-West) and overlapping between the buses and the metro line.

As regards the group “Society”, complementary indicator 8 (Intermodal User Comfort), was calculated using data coming from the standard Customer Satisfaction surveys projecting historical up to 2013 only the data related to intermodality (travel time, punctuality, availability of tickets, security information on schedules and routes)

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – A useful and replicable methodological approach was detected and described, as regards the re-organization of local PT network in presence of an innovative means of transport.
- **Key result 2** – A refinement of simulation assumptions was useful in order to improve a better scenario
- **Key result 3** – Simulated scenarios allowed also to simulate the integration between new local PT network and P&R service providing useful information about interchange parking size and to the number of potential users to be attracted.
- **Key result 4** – it's relevant to highlight the importance of micro simulations in order to improve quality of public space just outside the metro stations (i.e. road safety, pedestrian crossings, non-motorised vehicles level of Service).

- **Key result 5** – Focusing on disabled user needs was important in order to develop a high quality PT network.

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### **C7 Future activities relating to the measure**

Other slight refinements on scenario B\* could be possible mainly in relation to the actual amount of parking slots really provided in the P&R (the works are in progress) and in bike sharing stations positioned just outside the metro stations.

## D. Process Evaluation Findings

### D.0 Focused measure

This measure is not a focused one.

### D1 Deviations from the original plan

In this measure there is no evidence of deviations.

### D2 Barriers and drivers

#### D2.1 Barriers

In the sequel main barriers, which have been picked out during the measure implementation, are pointed out:

##### Preparation phase

- **Political/strategic barrier**–: there was delay in political choices related to the future role of the new PT network intended as a whole
- **Financial barrier**–: it was not possible to know beforehand if part of the funding - needed to complete the metroline - would come from the central government (Rome).

##### Implementation phase

- **Planning barrier** – The general master plan of the city was on-going during Civitas and the final size and location of the parking areas (for Park and Ride) was strictly related to the whole asset of the city that should be decided in the plan. As a matter of fact the future image of any city is closely linked to its PT transport network. The delay in choices had a direct consequence in macro and micro simulations (especially the ones made related to mixed use areas).

#### D2.2 Drivers

In the sequel main drivers, which have been picked out during the measure implementation, are pointed out:

##### Preparation phase

- **Planning driver** – Civitas project was a driver as the end of the project set a deadline to the simulation activities. That anticipated deadline was really important to have a “mature scenario” for metro start up by 2013.

##### Operational phase

- **Political/strategic driver** - The organization of a Target Group made up of all the ML involved in Metro package (M02.03 “Development and upgrade of the e-ticketing system in Brescia”, M03.03 “P&R facilities for underground and public transport systems in Brescia”, M08.05 “Brescia Mobile Channel”) was important to share information, define and optimize

the new transport network scenarios in order to carry out complete simulations, in the view of the start-up of the metro.

## D2.3 Activities

### Operational phase

**Intermediate scenario realization ("B scenario")** - In order to overcome the barriers, together with the ML of the Metro package, an intermediate scenario, called "Scenario B" was developed. It was used to point out the problems linked to the "Scenario K" and to help a more objective and technical discussion among politicians and stakeholders. After this activity, the final scenario (Scenario B\*) was built. The table below shows the value of the indicators collected for the Scenario B:

Indicator	After (timeline: 2013)
1) Ratio between km of simulated lines by type of PT and km of existing lines by type of PT	Ratio for the urban lines= 0.89 Ratio for the suburban lines = 0.90
2) Ratio between km per line and total km of PT	See the complete table reported in the detailed description of the indicator. Here you can find the minimum, maximum and average values:  min value = 0,28% max value = 3,16% average value = 1,43%
3.1. Simulated Traffic Flow in the peak hour	Detector n. 26 "Via da Vinci": Simulated transit = 1712 Detector n. 42 "Via Oberdan": Simulated transit = 1228
4. Average modal split	Private transport: 74.1% Public transport: 25.9%
5. Number of overlapping lines per link	2 links overlapped by 26 lines; 6.350 links covered by 1 single line
6. Number of interchanges per km per trip	0,343
7. Ratio between the number of simulated passenger and the number of passengers transported	29% of the daily passengers travels during the peak hour (190 equivalent days per year)
8. Intermodal User Comfort	7,68 / 10 (Projections of the indicator up to November 2013 when the metro line will be active using historical data up to July 2011)

Tab.3: Data collection of the Scenario B (intermediate scenario elaboration)

**Target group organization** - This activity was made by the Evaluation group to share information and input data (needed to build the scenarios) among the MLs involved in the Metro-package M02.03 "Development and upgrade of the e-ticketing system in Brescia", M03.03 "P&R facilities for underground and public transport systems in Brescia", M08.05 "Brescia Mobile Channel").

## **D3 Participation**

### **D.3.1 Measure partners**

- **Brescia Trasporti S.p.a.** - This society has been directly involved by the scenarios realization, considering that it manages the local PT in Brescia.
- **University of Brescia** - Besides the measure evaluation activities, it has organized and managed some meetings of the target group, in order to share information and input data used in scenarios. The strategic difficulties are resolvable through a major stakeholders involvement.

### **D.3.2 Stakeholders**

- **Brescia Municipality** - It had an important role during the preparation phase, because it participated to the selection of the address to be given to the scenarios.
- **Sintesi s.p.a** - This society manages in Brescia the parking and bike sharing services in Brescia; it has been involved in the measure implementation as regards the intermodal attitude study and implementation; as a matter of fact, it has been considered the necessity to integrate interchange parking and bike sharing stations with the new simulated local PT network.
- **Borgo Creativo** - this communication agency has been involved for the dissemination activities organized in the view of the metro start-up (2013).

## **D4 Recommendations**

### **D.4.1 Recommendations: measure replication**

- **Reorganization of the local PT with a new transport system realization** – in presence of a fundamental change in local PT transport, macro and micro simulation are needed. Furthermore scenarios' refinement is absolutely necessary to reach a mature vision of the new PT network balancing PT costs and its efficiency.
- **Intermodality with a new transport system** – in presence of a new local PT system, it's considered fundamental to measure intermodality (such as "Number of overlapping lines per link", "Number of interchanges per km per trip") during the simulation activities. In order to assess intermodality also quantitative aspects must not be undervalued, such as parking size, bike-sharing station size etc.

### **D.4.2 Recommendations: process**

- **Target group to share information** – the organization of a Target Group, involving the people in charge of different topics, is important in order to share information, uniform methodology, working hypothesis and objectives. This activity is considered fundamental.

**Annex 1: Historical data series for the BaU calculation**

- Ind. 2 (Ratio between km per line and total km of PT)

Line number	Line Name	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
1	S-cast-itis	12,91	2,24%
2	S-guss-luna	11,21	1,94%
3	S-ronc-cope	9,37	1,63%
4	S-ronc-itis	9,7	1,68%
5	S-staz-poli	2,65	0,46%
6	U_BUSS01_A	3,79	0,66%
7	U_BUSS01_R	4,6	0,80%
8	U_BUSS02_A	4,17	0,72%
9	U_BUSS02_R	4,3	0,75%
10	U_D01_A	6,05	1,05%
11	U_D01_R	6,19	1,07%
12	U_D02_A	6,58	1,14%
13	U_D02_R	5,8	1,01%
14	U_D03_A	8,44	1,46%
15	U_D03_R	7,57	1,31%
16	U_D04_A	6,03	1,05%
17	U_D04_R	3,7	0,64%
18	U_D05_A	6,2	1,08%
19	U_D05_R	6,25	1,08%
20	U_D06_A	16,92	2,93%
21	U_D06_R	15,3	2,65%
22	U_D07_A	8,18	1,42%
23	U_D07_R	7,34	1,27%
24	U_PER01_A	12,59	2,18%
25	U_PER01_R	12,88	2,23%
26	U_PER02_A	9,08	1,57%
27	U_PER02_R	7,74	1,34%
28	U_PER03_A	15,12	2,62%
29	U_PER03_R	12,84	2,23%
30	U_PER04_A	17,95	3,11%
31	U_PER04_R	12,3	2,13%
32	U_PMB01_A	14,68	2,55%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line Name	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
33	U_PMB01_R	12,4	2,15%
34	U_PMB02_A	7,96	1,38%
35	U_PMB02_R	8,13	1,41%
36	U_PMB03_A	10,66	1,85%
37	U_PMB03_R	10,66	1,85%
38	U_PMB04_A	14,92	2,59%
39	U_PMB04_R	16,06	2,79%
40	U_PMB05_A	6,89	1,20%
41	U_PMB05_R	5,04	0,87%
42	U_PMB06_A	11,04	1,91%
43	U_PMB06_R	9,56	1,66%
44	U_PMB07_A	7,72	1,34%
45	U_PMB07_R	8,29	1,44%
46	U_PMB08_A	10,55	1,83%
47	U_PMB08_R	11,65	2,02%
48	U_PMB09_A	11,58	2,01%
49	U_PMB09_R	11,41	1,98%
50	U_PMB10_A	13,96	2,42%
51	U_PMB10_R	14,29	2,48%
52	U_RAD01_A	8,9	1,54%
53	U_RAD01_R	10,62	1,84%
54	U_RAD02_A	14,15	2,45%
55	U_RAD02_R	12,54	2,17%
56	U_RAD03_A	15,03	2,61%
57	U_RAD03_R	16,78	2,91%
58	Ucolleb-itis	7,34	1,27%

Tab.A1.1: Ratio between km per line and total km of PT for BaU calculation

- Ind. 8 (intermodal users comfort)

	Ind. 8 Intermodal users comfort (concise judgement)
Nov-04	6,97
May-05	6,98
Jul-05	6,86

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

	<b>Ind. 8 Intermodal users comfort (concise judgement)</b>
Nov-05	6,74
May-06	6,68
Jul-06	6,93
Nov-06	7,21
May-07	7,02
Jul-07	7,09
Nov-07	7,22
May-08	7,11
Jul-08	6,87
Nov-08	7,46
May-09	7,19
Jul-09	7,30
Nov-09	7,35

*Tab.A1.2: intermodal users comfort*

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1** (*Ratio between km of simulated lines by type of PT and km of existing lines by type of PT*) – This indicator is expressed by the ratio between the simulated PT network extension and the existing network. The idea is to evaluate the possible reduction of the PT network extension as a consequence of the start-up of the new Metro line.

The model maps the PT offer on the road city network related to the O/D matrix (PT demand).

In order to calculate the indicators it was made the sum of the lengths of all the lines represented in the simulation model for the considered scenarios. For the extra-urban lines, it was considered only those which had relationships with the city. The simulated extension is divided by the existing PT network.

### EX ANTE SITUATION (simulation of the existing network)

Ratio for the urban lines= 1

Ratio for the extra-urban lines = 1

### EX POST DATA COLLECTION (SCENARIO B with the metro)

Ratio for the urban lines= 0.89

Ratio for the extra-urban lines = 0.90

### EX POST DATA COLLECTION (SCENARIO B\* with the metro)

Ratio for the urban lines= 0.88

Ratio for the extra-urban lines = 0.91

NOTICE: Obtained values show a general reduction of the Bus network extension considering the scenario B respect to the simulation of the existing network.

- **Indicator 2** (*Ratio between km per line and total km of PT*) – For each line the length of the itineraries has been reported and the percentage (respect to the total) has been calculated, in order to know how weigh of each line respect to the total PT network. The final indicator resumes the minimum, the maximum and the average values, respectively corresponding to the shortest line, the longest line and the average length of all the lines.

### EX ANTE SITUATION (simulation of the existing network)

The complete results are reported in the following table:

Line number	Line name	Line length (km)	% respect to the total PT routes length
1	momp-masa	14,4	1,42%
2	masa-momp	13,95	1,38%
3	pend-iacp	12,56	1,24%
4	iacp-pend	13,79	1,36%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line name	Line length (km)	% respect to the total PT routes length
5	badi-rezN	17,31	1,71%
6	rezN-badi	16,62	1,64%
7	badi-rezS	17,38	1,72%
8	rezS-badi	18,54	1,83%
9	badi-bern	9,54	0,94%
10	bern-badi	9,58	0,95%
11	vitt-folz	8,86	0,88%
12	folz-vitt	8,09	0,80%
13	ppVI-madd	6,62	0,65%
14	madd-ppVI	6,63	0,66%
15	cain-ronc	22,88	2,26%
16	ronc-cain	23,45	2,32%
17	nave-ronc	18,83	1,86%
18	ronc-nave	19,4	1,92%
19	sgal-caio	15,4	1,52%
20	caio-sgal	14,11	1,40%
21	viol-buff	19,87	1,97%
22	buff-viol	17,37	1,72%
23	conc-ponc	24,46	2,42%
24	ponc-conc	24,3	2,40%
25	bove-fler	19,03	1,88%
26	fler-bove	18,12	1,79%
27	bott-stoc	20,11	1,99%
28	stoc-bott	18,32	1,81%
29	caio-stoc	17,18	1,70%
30	coll-caio	17,18	1,70%
31	fium-spol	12,76	1,26%
32	spol-fium	10,44	1,03%
33	guss-poli	15,7	1,55%
34	poli-guss	16,75	1,66%
35	staz-sant	10,73	1,06%
36	sant-staz	11,53	1,14%
37	staz-cpdm	11,39	1,13%
38	cpdm-staz	14,77	1,46%
39	mont-gire	18,24	1,80%
40	noce-mont	12,99	1,29%
43	onza-gior	21,95	2,17%
44	gior-onza	22,08	2,18%
45	viol-gior	18,32	1,81%
46	gior-viol	17,05	1,69%
47	cmel-ospe	18,67	1,85%
48	ospe-cmel	17,01	1,68%
49	Forn-ospe	15,42	1,53%
50	ospe-forn	13,5	1,34%
51	ivec-cast	3,79	0,37%
52	cast-ivec	4,6	0,46%
60	s iacp-gamb	10,93	1,08%
61	s staz-past	3,99	0,39%
62	s rezN-itis	15,14	1,50%
63	rezN-badi	9,71	0,96%
64	s cain-cope	16,29	1,61%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line name	Line length (km)	% respect to the total PT routes length
65	s cain-staz	15,69	1,55%
66	s ronc-cope	9,4	0,93%
67	s ronc-cain	23,64	2,34%
68	s conc-ponc	24,6	2,43%
69	s ponc-conc	24,77	2,45%
70	s ponc-conc	12,71	1,26%
71	s bott-gamb	17,31	1,71%
72	s bott-duca	11,15	1,10%
73	s staz-past	4,89	0,48%
74	s staz-poli	2,58	0,26%
75	s guss-cano	12,78	1,26%
76	stazi-golg	5,18	0,51%
77	staz-albe	5,1	0,50%
78	onza-luna	13,38	1,32%
Total length		1010,81	100%

Tab.A2.1: Ratio between km per line and total km of PT - existing network scenario

Indicator 2: min value = 0,26 %  
max value = 2,45 %  
average value = 1,45 %

## EX POST DATA COLLECTION (SCENARIO B with the metro)

Line number	Line Name	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
1	line_1	25,41	2,68%
2	line_2	22,17	2,34%
3	line_3	10,32	1,09%
4	line_4	25,63	2,70%
5	line_5	22,39	2,36%
6	line_6	10,98	1,16%
7	line_7	30,03	3,16%
8	line_8	14,74	1,55%
9	line_9	19,9	2,10%
10	line_10	23,89	2,52%
11	line_11	14,64	1,54%
12	line_12	19,8	2,09%
13	line_13	16,9	1,78%
14	line_14	11,51	1,21%
15	line_15	17,71	1,87%
16	line_16	12,32	1,30%
17	line_17	19,89	2,10%
18	line_18	18,27	1,93%
19	line_19	13,03	1,37%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line Name	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
20	line_20	11,41	1,20%
21	line_21	18,97	2,00%
22	line_22	18,34	1,93%
23	line_23	10,11	1,07%
24	line_24	9,45	1,00%
25	line_25	6,24	0,66%
26	line_26	6,21	0,65%
27	line_27	7,56	0,80%
28	line_28	18,46	1,95%
29	line_29	7,61	0,80%
30	line_30	18,59	1,96%
31	line_31	12,2	1,29%
32	line_32	16,55	1,74%
33	line_33	9,06	0,95%
34	line_34	11,69	1,23%
35	line_35	15,75	1,66%
36	line_36	8,83	0,93%
37	line_37	21,5	2,27%
38	line_38	19,09	2,01%
39	line_39	21,3	2,24%
40	line_40	18,82	1,98%
41	line_41	20,3	2,14%
42	line_42	19,57	2,06%
43	line_43	16,64	1,75%
44	line_44	16,77	1,77%
45	line_45	9,9	1,04%
46	line_46	12,21	1,29%
47	line_47	5,73	0,60%
48	line_48	3,92	0,41%
49	line_49	6	0,63%
50	line_50	4,45	0,47%
51	line_51	11,2	1,18%
52	line_52	5,7	0,60%
53	line_53	10,17	1,07%
54	line_54	4,89	0,52%
55	line_55	20,57	2,17%
56	line_56	19,72	2,08%
57	line_57	5,28	0,56%
58	line_58	3,93	0,41%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line Name	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
59	line_59	9,61	1,01%
60	line_60	13,77	1,45%
61	line_61	4,09	0,43%
62	line_62	13,19	1,39%
63	line_63	15,51	1,63%
64	line_64	15,21	1,60%
65	line_65	4,05	0,43%
66	line_66	3,94	0,42%
67	line_67	8,53	0,90%
68	line_68	11,21	1,18%
69	line_69	2,65	0,28%
70	line_70	12,91	1,36%
Total Length		948,89	100,00%

Tab.A2.2: Ratio between km per line and total km of PT - B (intermediate) scenario

Indicator 2: min value = 0,28 %  
max value = 3,16 %  
average value = 1,43%

## EX POST DATA COLLECTION (SCENARIO B\* with the metro)

Line number	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
1	22,16	2,35%
2	13,38	1,42%
3	25,24	2,68%
4	20,12	2,14%
5	22,89	2,43%
6	6,33	0,67%
7	6,12	0,65%
8	16,72	1,78%
9	16,85	1,79%
10	9,93	1,05%
11	13,04	1,38%
12	12,47	1,32%
13	12,74	1,35%
14	10,37	1,10%
15	15,51	1,65%
16	10,55	1,12%
17	15,69	1,67%
18	11,8	1,25%

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

Line number	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
19	12,01	1,28%
20	10,56	1,12%
21	5,39	0,57%
22	10,29	1,09%
23	5,4	0,57%
24	25,99	2,76%
25	24,99	2,65%
26	26,25	2,79%
27	11,23	1,19%
28	2,78	0,30%
29	9,48	1,01%
30	13,72	1,46%
31	10,65	1,13%
32	10,88	1,16%
33	20,93	2,22%
34	13,88	1,47%
35	14,69	1,56%
36	15,3	1,62%
37	13,68	1,45%
38	21,27	2,26%
39	18,66	1,98%
40	16,96	1,80%
41	11,54	1,23%
42	15,88	1,69%
43	26,24	2,79%
44	2,7	0,29%
45	16,03	1,70%
46	21,75	2,31%
47	23,54	2,50%
48	18,99	2,02%
49	19,03	2,02%
50	14,36	1,53%
51	8,4	0,89%
52	15,52	1,65%
53	8,42	0,89%
54	25,65	2,72%
55	21,56	2,29%
56	10,93	1,16%
57	19,89	2,11%

Line number	Line length (km)	% respect to the total PT routes length (excluding the Metro Line)
58	9,93	1,05%
59	23,07	2,45%
60	18,54	1,97%
61	20,46	2,17%
62	12,25	1,30%
	941,58	100%

Tab.A2.3: Ratio between km per line and total km of PT - B\* scenario

Indicator 2: min value = 0,29 %  
max value = 2,79 %  
average value = 1,61 %

- **Indicator 3** (*Traffic Flow peak/off-peak*) – **INDICATOR NO MORE COLLECTED**
- **Indicator 3.1** (*Simulated Traffic Flow in the peak hour*) – For each simulation model considered, the simulated private traffic of the peak hour is calculated, for 2 significant road sections, in order to assess if the new simulated scenarios are able to influence the private traffic flows during the morning peak hour.  
The recent introduction of this indicator (January 2011) doesn't cause any problem in the ex-ante data collection because this indicator can be calculated from the simulation models in any moment.

**EX ANTE SITUATION** (simulation of the private traffic flows for the simulated existing network without the metro line)

Detector n. 26 "Via da Vinci":  
Simulated transit = 1703

Detector n. 42 "Via Oberdan":  
Simulated transit = 1369

**EX POST SITUATION** (simulation of the private traffic flows for the scenario B with the metro line)

Detector n. 26 "Via da Vinci":  
Simulated transit = 1712

Detector n. 42 "Via Oberdan":  
Simulated transit = 1228

**EX POST SITUATION** (simulation of the private traffic flows for the scenario B\* with the metro line)

Detector n. 26 "Via da Vinci":  
Simulated transit = 1712

Detector n. 42 “Via Oberdan”:  
Simulated transit = 1228

- **Indicator 4** (*Average modal split*) – It is expressed as the repartition between the public and the private mobility demand as they can be extracted by the simulation models.

From the model point of view it is the ratio between the matrix of the PT mobility and the one on private mobility. The introduction of the metro line should influence this indicator increasing the PT mobility.

**EX ANTE SITUATION** (simulation of the existing network without the metro)

private transport: 85.5%  
public transport: 14.5%

**EX POST DATA COLLECTION** (SCENARIO B with the metro)

Private transport: 74.1%  
Public transport: 25.9%

**EX POST DATA COLLECTION** (SCENARIO B\* with the metro)

Private transport: 74.1%  
Public transport: 25.9%

- **Indicator 5** (*Number of overlapping lines per link*) – This indicator expresses the number of overlapping PT lines on the road segments (links) that compose the road network of Brescia and the served metropolitan area (14 neighbouring municipalities). It is expressed by a graph which reports, on the y axis, the number of road segments (links) and, on the x axis, the number of PT lines that overlap on each single segment. The graph gives an idea of the overlapping level of the public transport lines respect to the road network.

**EX ANTE SITUATION** (simulation of the existing network without the metro)

In the simulation of the existing network (without the metro), some areas of the city play a connection role in relation to different bus lines. The most clear example is represented by the railway station in which all the terminals of the extra-urban lines are very closed to many urban lines stops. As it's possible to see in the graph below, the existing network is characterized by strong corridors with many bus lines that overlap each other.

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

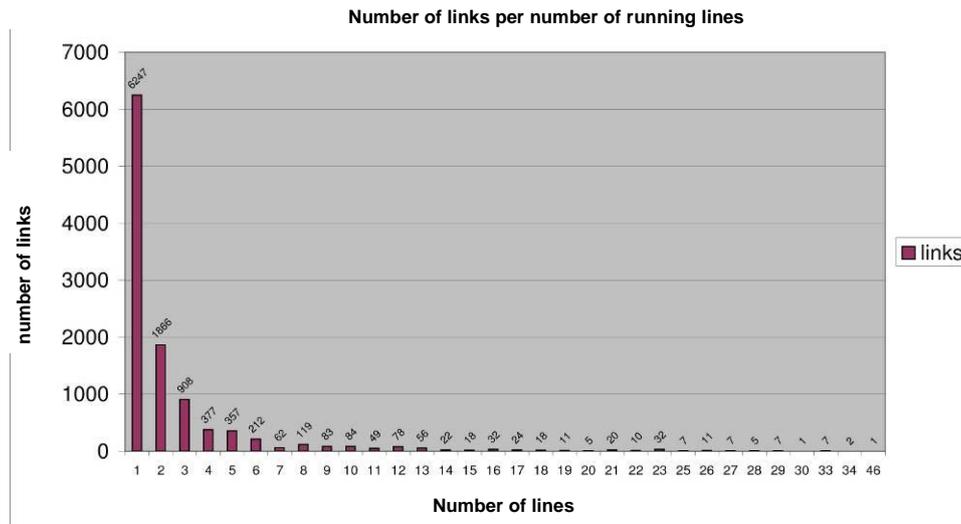


Fig. A2.1: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

This indicator can be synthesized by two values: the first one is expressed by the number of road links overlapped by the total number of lines composing the network; the second one is expressed by the maximum number of links covered by one single line.

The ex-ante of Ind. 5 (existing network) is expressed by the following values:

- 1 link overlapped by 46 lines;
- 6.247 links covered by 1 single line

## EX POST DATA COLLECTION (SCENARIO B with the metro)

With the simulation of the B scenario, the metro line should cover the main corridors that were covered by the busses in the simulation of the existing network, therefore, the number of overlapping lines is lower.

Measure title: **INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

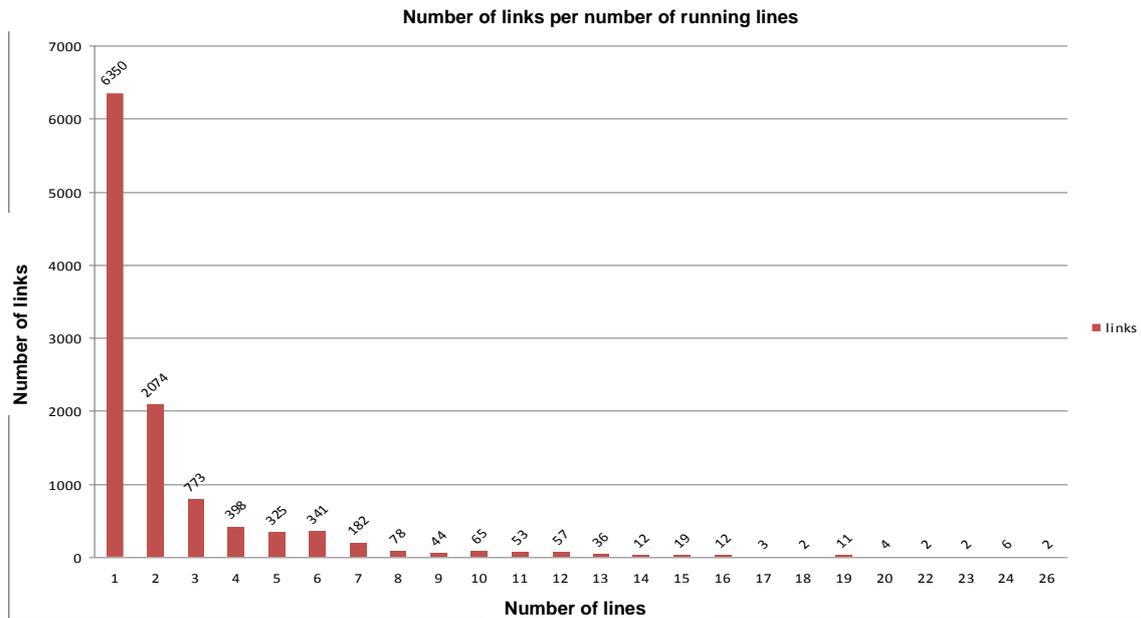
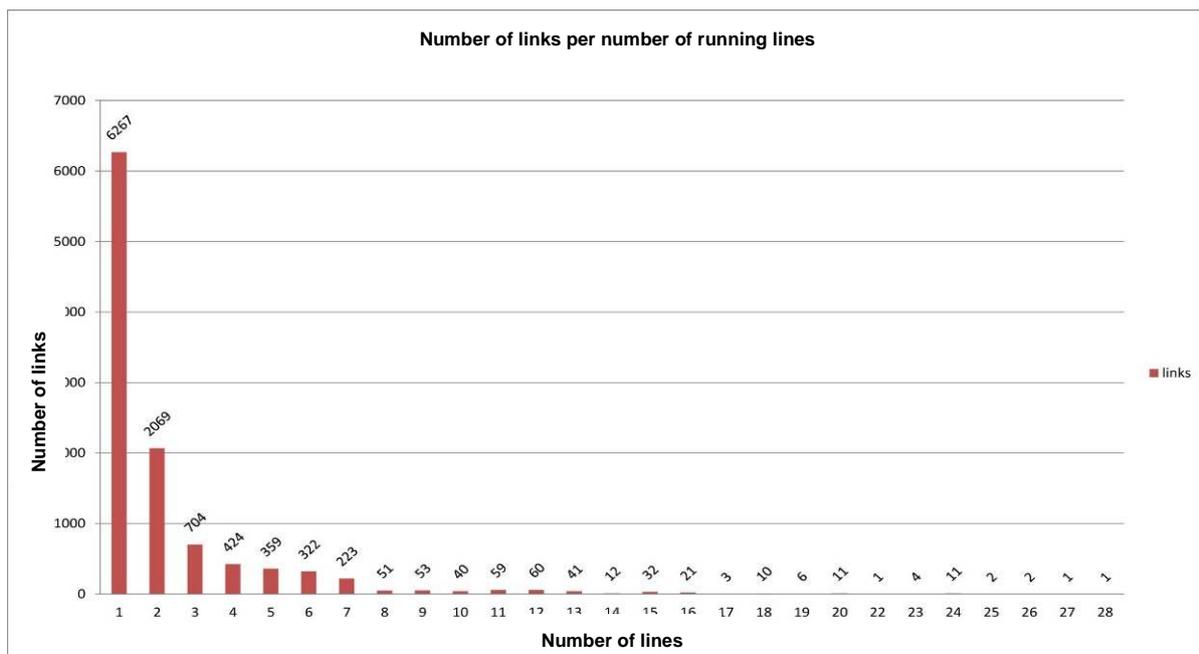


Fig. A2.2: Number of overlapping PT lines on each road segment (links) – Simulation of the B network scenario

The ex post of Ind. 5 (scenario B) is expressed by the following values:

- 2 links overlapped by 26 lines;
- 6.350 links covered by 1 single line

**EX POST DATA COLLECTION (SCENARIO B\* with the metro)**



*Fig. A2.3: Number of overlapping PT lines on each road segment (links) – Simulation of the B\* network scenario*

The ex post of Ind. 5 (scenario B\*) is expressed by the following values:  
4 links overlapped by 23 lines;  
6.535 links covered by 1 single line

- **Indicator 6** (*Number of interchanges per km of trip*) – This indicator expresses the number of interchanges per km of trip made using the public transport (both urban and suburban lines) in the metropolitan area (city and 14 municipalities). The model identifies which lines are used to move from an Origin to Destination and the number of interchanges needed to reach the destination.

#### **EX ANTE SITUATION** (simulation of the existing PT network without the metro)

ind. 6 = 0.318

#### **EX POST DATA COLLECTION** (SCENARIO B with the metro)

The attended results of the simulated network for the Metro start-up are an increasing of the number of the interchanges with a reduction of the total journey. The high number of interchanges is a positive results with the presence of a high performance transport service characterized by the presence of a metro line: people is more favourably disposed toward frequent interchanges between bus and metro than between busses.

ind. 6 = 0.343

#### **EX POST DATA COLLECTION** (SCENARIO B\* with the metro)

The attended results of the simulated network for the Metro start-up are an increasing of the number of the interchanges with a reduction of the total journey. The high number of interchanges is a positive results with the presence of a high performance transport service characterized by the presence of a metro line: people is more favourably disposed toward frequent interchanges between bus and metro than between busses.

ind. 6 = 0.346

- **Indicator 7** (*Ratio between the number of simulated passenger and the number of passengers transported*) – This indicator is expressed by the ratio between the simulated passengers of the peak hour and total passengers simulated per day on the PT network. It's used to evaluate the weight of the peak hour in relation to all the day. The daily simulated passengers are calculated by the model (through a coefficient) according to the yearly passengers.

#### **EX ANTE SITUATION** (simulation of the existing PT network without the metro)

According to the overall methodology adopted for this measure, the ex-ante situation is referred to the existing PT Network and data are collected from its model simulation.

ind. 7 = 29% of the daily passengers travels during the peak hour (190 equivalent days per year)

#### **EX POST DATA COLLECTION (SCENARIO B with the metro)**

For the B PT network scenario including the metro line, the value of this indicator would equal (or at least be lower) the one calculated for the ex-ante situation (referred to the existing PT network scenario without the metro line). The reason is to equally evaluate the projection of the number of passenger/year, basing it on the number of transported passenger during the peak time.

This hypothesis is precautionary, as at the moment it's not possible to establish if the new PT network is going to introduce a significant variation in the overall perception of the network including the future metro line. In principle, it is expected a higher aptitude toward the use of the PT during the off-peak time. The difference between the peak-time values and the off-peak time values should decrease and as a consequence the number of the total number of passengers/day or passengers/year should increase.

ind. 7 = 29% of the daily passengers travels during the peak hour (190 equivalent days per year)

#### **EX POST DATA COLLECTION (SCENARIO B\* with the metro)**

ind. 7 = 29% of the daily passengers travels during the peak hour (190 equivalent days per year)

- **Indicator 8 (Intermodal User Comfort)** – This indicator, calculated using data coming from the standard Customer Satisfaction surveys, has been set as complementary, because it gives an estimation of the perceived quality of service by the PT users, also concerning the new simulated network scenarios (which include the metro line). The indicator can be estimated projecting the historical data series up to 2013, when the metro line will be actually activated.

The survey is made each 4 months with interviews to the users. The interview amount is 1200. The people interviewed are chosen in a double way: interviews at the bus stop and phone interviews. For the interviews at the bus stops, the bus stops are selected with a particular focus on terminals or on specific lines; for the phone interviews a casual extraction among the people registered in the lists of the holders of Omnibus Card is made according to the typology of trip loaded. 700 questionnaires are proposed face to face at the bus stops and/or on the busses of Brescia Trasporti and 500 are proposed by phone interview according to the references of Brescia Trasporti. The activity has been planned associating traditional surveys (structured questions, semi structured and open ones) and innovative methodologies tested by Summa that allows to manage the information coming from indirect survey. According with the methodologies used, the witness is able to express its position or opinion about certain subject without preconceived answers and taking over all content delivered spontaneously. The obtained indications are introduced into a dynamic database and analysed carefully, focusing on key concepts and on the additional ones, and it is possible to draw assessments and rigorous statistics, qualitative in-depth.

Indicator n.8 “Intermodal User Comfort” is defined as the average value among four out of the eight indicators composing the standard customer satisfaction survey. The average value was related to the base 10 to facilitate customer profiling.

It was considered the following indicators: travel time, punctuality, availability of tickets, and information on schedules and routes.

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The answers given by customers are translated into scores as follows:

Mode Score	
Very satisfactory .....	5
Satisfying .....	4
Indifferent (neither satisfactory nor unsatisfactory) .....	3
Unsatisfactory .....	2
Very unsatisfactory .....	1

It was calculated, for each question, the average value between those for the 1209 people interviewed. The average value was related to the base 10 for easier understanding and evaluating.

**EX ANTE SITUATION** (November 2009)

The ex-ante situation is referred to the existing network scenario, and the indicator, in this case, refers to the results of the Customer Satisfaction carried out in November 2009.

ind. 8 = 7,35 / 10

**AFTER DATA COLLECTION** (new PT network scenario B including the metro)

The calculation of this indicator is made projecting, up to November 2013 (when the metro line will be active) the data coming from the Customer Satisfaction surveys up to July 2011, when the scenario B has been elaborated. The projections is reported in the following graph.

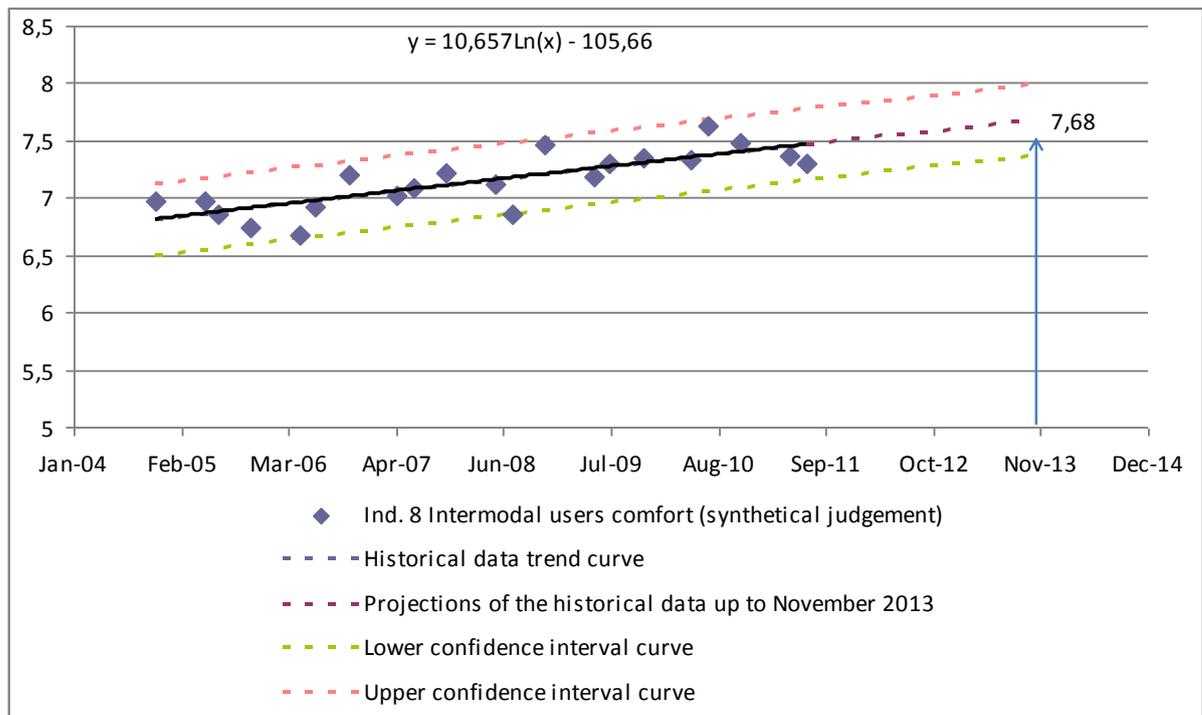


Fig. A2.4: Projection of the intermodal user comfort

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ind. 8 = 7,68 / 10

## AFTER DATA COLLECTION (new PT network scenario B\* including the metro)

The calculation of this indicator is made projecting, up to November 2013 (when the metro line will be active) the data coming from the Customer Satisfaction surveys up to May 2012, when the scenario B\* has been elaborated. The projections is reported in the following graph.

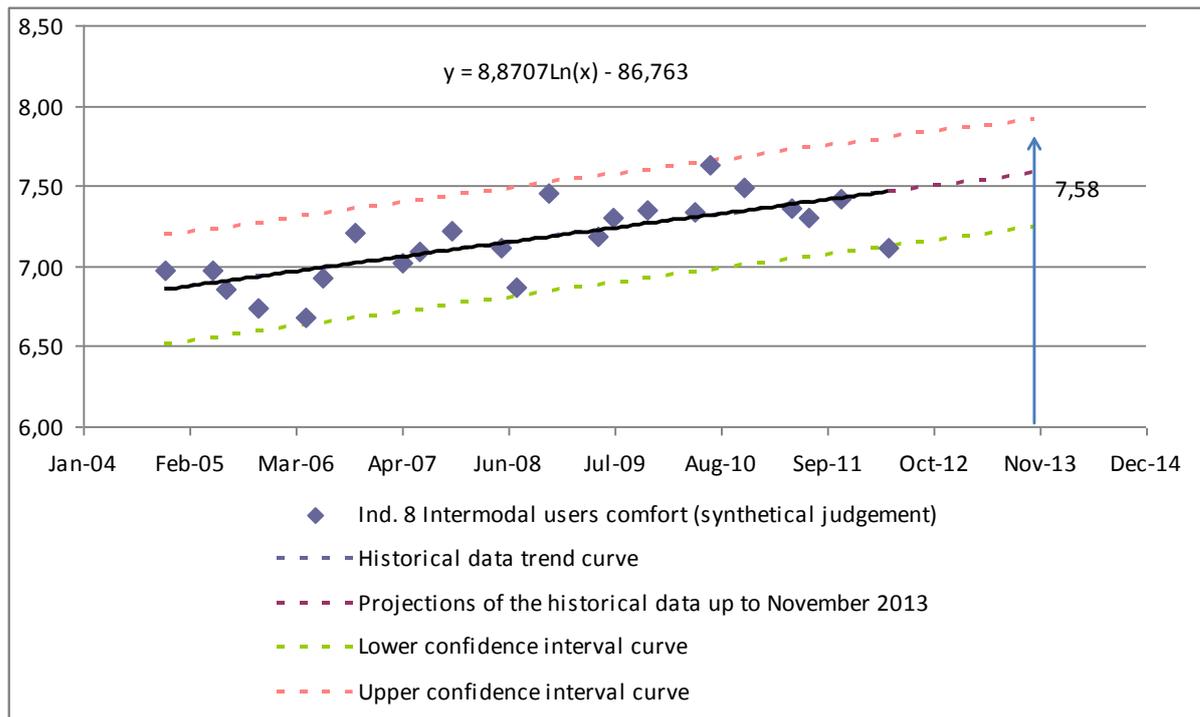


Fig. A2.5: Projection of the intermodal user comfort

ind. 8 = 7,58 / 10

## Annex 3: Focus Group Activities

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
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<b>Title</b>	<b>Impostazione dei Focus Group</b>
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità

STEP 1	<b>Accoglienza e riscaldamento (circa 10 minuti)</b>		
	1) Presentazione degli invitati al gruppo di discussione. 2) Presentazione dei ricercatori.		
STEP 2	<b>Introduzione al tema della discussione (circa 10 minuti)</b>		
	3) Motivazione e condizioni (fasi e tempi) dell'incontro di gruppo in data _____ - Metro Package (MP); - lighthouse measures; - indicatori.		
STEP 3	4) Gli obiettivi dell'incontro sono:		
	- condivisione metodologia per lo svolgimento del Focus Group;		
	- attuazione del Focus Group.		
	<b>Fasi della ricerca: descrittiva, riflessiva e propositiva</b>		
	TEMA	MISURA	METROPACKAGE
Azzeramento della conoscenza e condivisione degli input (ipotesi scenari)			
Potere decisionale in relazione al tipo di scelta da attuare			
Percezione di rischi/problematiche oltre Civitas (ad esempio, entrata in esercizio della metro)			
Ruolo di ciascun intervento per il funzionamento del MP:			
- bike sharing; - parcheggi; - BMC; - intermodalità; - e-ticketing; - politiche di tariffazione; - gestione della mobilità.			
STEP 4	<b>Verifica di fattibilità e scelta finale</b>		
STEP 5	<b>Assegnazione dei ruoli</b>		
STEP 6	<b>Sintesi dei risultati:</b>		
	- per singola misura; - per Metro Package		

## General structure of the Focus Group activities

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
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<b>Title</b>	<b>Impostazione dei Focus Group</b>	
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel	
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità	
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>
<b>Date: 15 november 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari
	BSM	Sbardella, Gussago, Ragnoli, Pace
	BST	Sutera
	CBS	Bresciani
	BICIMIA	Verità

<b>Main topics</b>	<ol style="list-style-type: none"> <li>1) Scambio ERT tra i vari Partner per condividere le attività previste nelle diverse misure;</li> <li>2) Rivedere i contenuti insieme, in modo da avere COERENZA nella descrizione delle misure;</li> <li>3) Prevedere un rimando corretto e concordato in tutte le misure collegate (es. 02.02 e 02.03);</li> <li>4) Coinvolgimento Bicimia (geom. Verità) per testare l'efficacia della distribuzione delle tessere OMNIBUS e il loro funzionamento per gestione P&amp;R (verificare tracciabilità dei dati) e scegliere un Parcheggio + BICIMIA (x es. in centro), dove si hanno dati e uso della OMNIBUS</li> <li>5) considerare solo timbrature e uso delle OMNIBUS (no altre carte!!!)</li> <li>6) necessità di ricevere (dal CBS??) una tavola con la localizzazione dei Parcheggi per la Metropolitana e il numero degli stalli (deve essere base condivisa!!!)</li> <li>7) usare modello di BSM come previsto nella M02.02</li> <li>8) concentrarsi anche solo su uno scenario, Parcheggio e analizzarlo benissimo!!</li> <li>9) portare dati e info al prossimo incontro (15 dicembre)</li> <li>10) rendicontare questa attività nel Process Evaluation Form (Focus, coordinamento e condivisione)</li> <li>11) vedere indicatori delle misure, in particolare quelli legati alla simulazione metropolitana e collaborare per la raccolta (usare modello della M02.02)</li> </ol>
	Prossimo incontro fissato per il 19 Dicembre 2011 a Brescia Mobilità

*Focus Group activities – Convocation of the 1<sup>th</sup> meeting (15 November 2011)*

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	Brescia University	FOCUS GROUP ACTIVITIES	CIVITAS MODERN
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<b>Title</b>	<b>Impostazione dei Focus Group</b>	
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel	
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità	
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>
Date: <b>19 dicembre 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari
	BSM	Sbardella, Gussago, Ragnoli, Pace
	CBS	Bresciani

<b>Main topics</b>	1) Verifica dello scambio dei dati di input per la coerenza degli scenari per i parcheggi; 2) inquadramento delle misure M02.03 e M08.05 (in qualità di possibili lighthouse measures) all'interno del Metro Package; 3) cronogramma della M02.03; 4) soluzioni trovate per la registrazione dell'utilizzo del servizio P&R per gli utenti occasionali (sistemi, fornitura, test); 5) determinazione e consapevolezza della capacità decisionale che il ML ha come responsabile della misura; 6) analisi della percezione di rischi/problematriche oltre Civitas; 7) definizione del ruolo del Mobility Manager all'interno del Focus Group 8) proposta dell'organizzazione di un Focus Group aperto al pubblico (individuando persone da coinvolgere) per avere opinioni e aspettative da parte dell'utenza in merito a bike sharing, parcheggi, BMC, ecc., da considerarsi come azione di dissemination
	Prossimo incontro possibile: prima della riunione tecnica di febbraio

Focus Group activities – Convocation of the 2<sup>nd</sup> meeting (19 December 2011)

## **Annex 4: Description of the developed scenarios**

The start-up of the innovative metro line in the city of Brescia, foreseen in 2013, inevitably entails a profound review of the public transport system. Bounds and criteria to set down the new network evolve constantly right from the start of the planning stage of the metro line at the beginning of the 90's. In this long time, more or less valid hypotheses or more political than technical ones follow one another. Therefore, while the metro start-up was coming nearer, a review of past studies was necessary, setting up a methodological approach, starting from the current situation. This one in some way brings forward the metro line, through the High mobility Route (LAM) 1. This kind of approach foresees to verify the behaviour of a "extreme" network (scenario K) and to define first more plausible scenario (named B), basing on results from scenario K and on imposed bounds. A further scenario, called scenario B\*, coming from scenario B results, is considered as definitive one.

Following two figures are reported: the first is about the current public transport system; the second is about the new zoning of the city, used to build up the different scenarios.

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

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Measure number: **02.02**

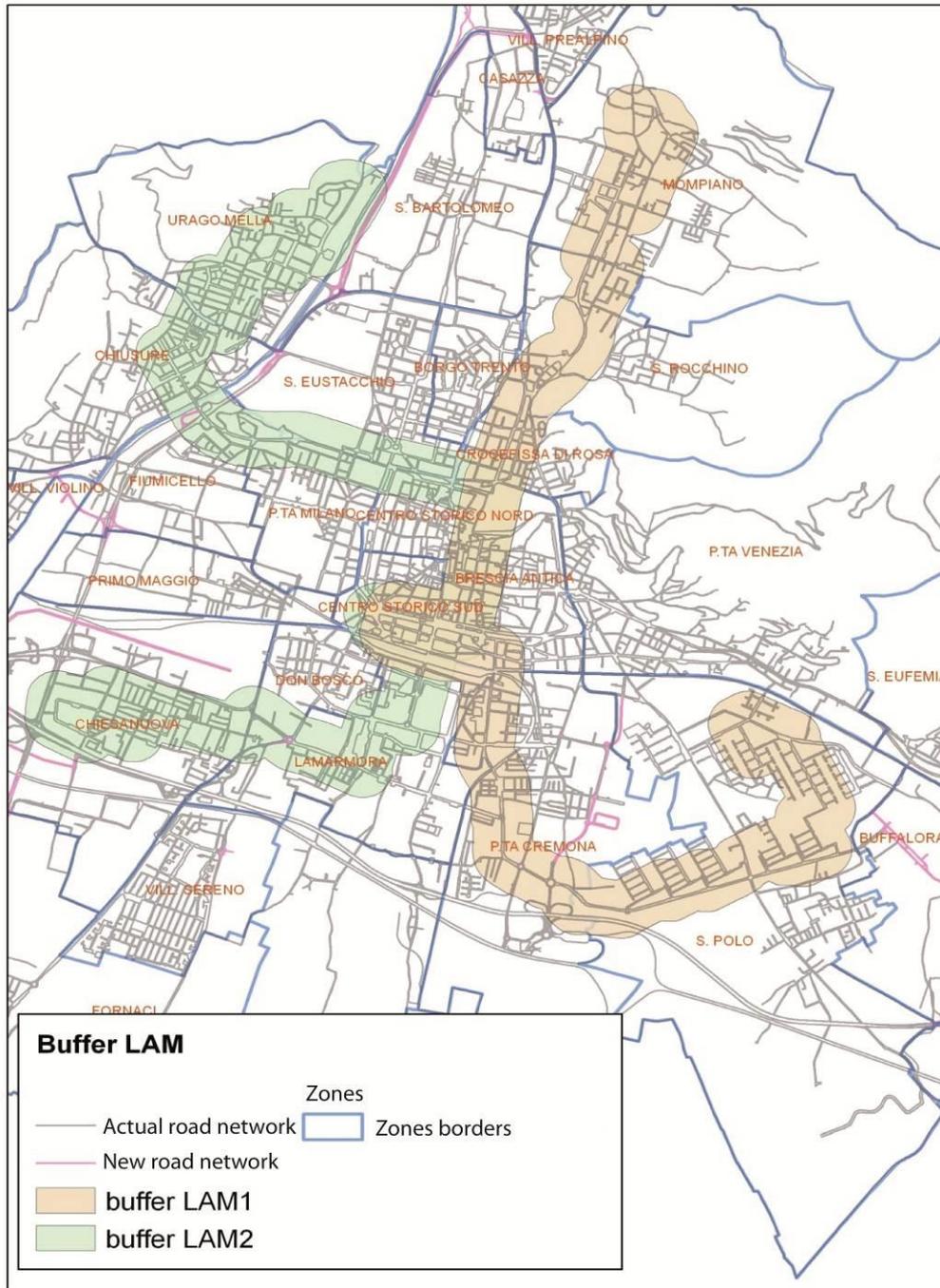


Fig.A4.1: Existing public transport system

Measure title:

# INTERMODALITY WITH PUBLIC TRANSPORT IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **02.02**

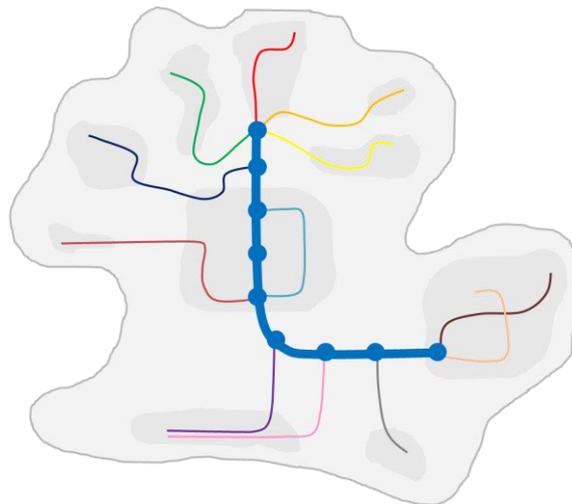


Fig.A4.2: New zoning of the city of Brescia used to build up different scenarios

- **EXISTING SCENARIO (used as Baseline)**

The current urban public transport system ensues from a early study, carried out in 1998 by consultancy Steer Davies Gleave, in support of Transport Section office in ASM multi-utility. The study foresaw an analysis of the current level of service, the evaluation of the number of potential users not yet served by public transport system and to formulate a propose of two LAM, which were characterized by a specific brand and were the frame of the new transport system. Therefore, the necessity to improve the “image” of the system was highlighted, in order to strengthen the public transport service. This objective were the starting point of the project of LAM and of the extension of the fast-tracks and of street furniture. The LAMs routes evaluation came from the current and the foreseen urban frame of the city. As a matter of fact LAM 1 route is the same as the metro line, and it’s an evidence for the existing predominant transport “corridor”. The spread of the public transport lines to the neighbouring cities was another studied issue. The present transport system started up in July 2004.

- **SCENARIO K (used as BaU)**



*Fig. A4.3- Radial line PT network (Scenario K)*

The reference frame of the metrobus project applies to the first functional stretch, which foresees the start-up of automatic line from the metro depot in S. Eufemia (Via Serenissima), to the end of the line in Prealpino Village, as established in two deliberations of Municipality Council (n° 262/PG49086 on 16/12/2002 “Automatic Metroline First Functional Stretch” and n° 205/PG37264 on 8/12/2004 “Automatic Metroline First Functional Stretch – Variation and specifications”). This scenario was planned out to adapt the busses transport network to the metro line (extreme hypothesis), in order to evaluate the simulation models response, as described in Civitas paper “Comparative assessment of a new urban public network with Metrobus in the city of Brescia” on 11/10/2010.

The project of the new local PT system is based on following bounds:

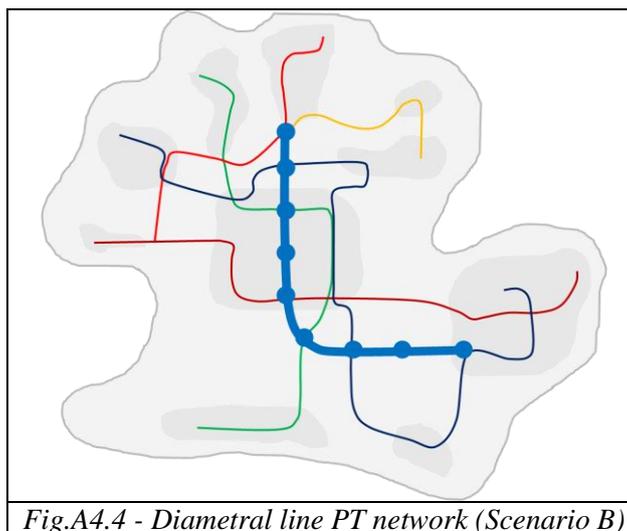
- Metro line first functional stretch S. Eufemia – Prealpino Village;
- dislocation of potential residual users;
- staging post of suburban busses lines from Val Trompia at Prealpino metro station;
- staging post of suburban busses lines at S. Eufemia metro station

- staging post of remaining suburban busses lines at South and North terminal at the station and at metro station;
- realization of suburban busses stops next to the metro stations, if first ones haven't staging post;
- use of existing fast-tracks without LAMs;
- the plan of the new local PT network foresees that each bus line allows interchange with metrobus;
- reduction of bus lines through the city centre;
- high reduction of length of bus lines;
- possibility of passengers load breaking next to metro stations;
- maintaining of current suburban busses lines for the school service;
- possibility of modify/integration of urban lines for the school service.

The obtained local PT system subdivide the urban and suburban lines among following categories:

- urban direct lines: direct connection among suburban quarters, not served with the metro line;
- suburban lines on metrobus: direct connection of suburban lines, from the metropolitan area, with the nearer metro station;
- urban diametric lines: connection among suburban quarters, not served with the metro line, by lines through the city centre;
- urban suburban lines: connection among suburban quarters with lines not across the city centre, but with at least a connection with a metro station;
- plan of a new line with 8 m long vehicles from the station to the Freccia Rossa shopping centre, the city centre and "Comparto Milano".

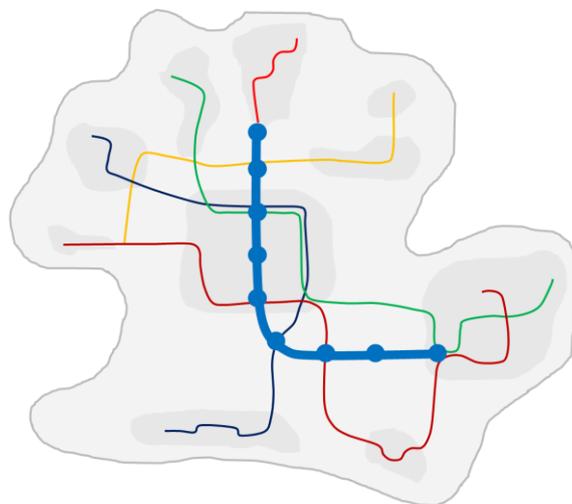
- **SCENARIO B (after data collection)**



The project of the new local PT system is based on following bounds:

- Metro line first functional stretch S. Eufemia – Prealpino Village;
- dislocation of potential residual users;
- staging post of suburban busses lines from Val Trompia at Prealpino metro station;
- staging post of suburban busses lines at S. Eufemia metro station;
- bus lines are diametric in respect to the metro line;
- no overlap among different lines and the metro line;
- the plan of the new local PT network foresees that each bus line allows interchange with metrobus;
- the length of bus lines has as dimensional bound the values defined in the deliberation of Municipality Council n°205 on 08/10/2004: acknowledging the metrobus financing plan, 2,5 mil of vehicle per km is the reduction foreseen on the road network (referring to the current organization). This numerical bounds are subdivided into urban service (1,5 mil) and suburban service (1 mil);
- the busses routes should converge on metro stations, avoiding overlap of the service, studying the routes themselves and the end of the lines;
- maintaining of current suburban busses lines for the school service in order to strengthen the connection of the station with schools.

- **SCENARIO B\* (after data collection)**



*Fig. A4.5 - Diametric line PT network (Scenario B\*)*

This scenario is the result of several change of hypothesis used in the realization of the Scenario B; as a matter of fact, changes regarded:

- the details of the lines through the different districts;
- the relations among the ends of the lines;
- frequency of every simulated line.

The project of the new local PT system is based on following bounds:

- Metro line first functional stretch S. Eufemia – Prealpino Village;
- dislocation of potential residual users;

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- staging post of suburban busses lines from Val Trompia at Prealpino metro station;
- staging post of suburban busses lines at S. Eufemia metro station;
- bus lines are diametric in respect to the metro line;
- no overlap among different lines and the metro line;
- the plan of the new local PT network foresees that each bus line allows interchange with metrobus;
- the length of bus lines has as dimensional bound the values defined in the deliberation of Municipality Council n°205 on 08/10/2004: acknowledging the metrobus financing plan, 2,5 mil of vehicle per km is the reduction foreseen on the road network (referring to the current organization). This numerical bounds are subdivided into urban service (1,5 mil) and suburban service (1 mil);
- the busses routes should converge on metro stations, avoiding overlap of the service, studying the routes themselves and the end of the lines;
- maintaining of current suburban busses lines for the school service in order to strengthen the connection of the station with schools.

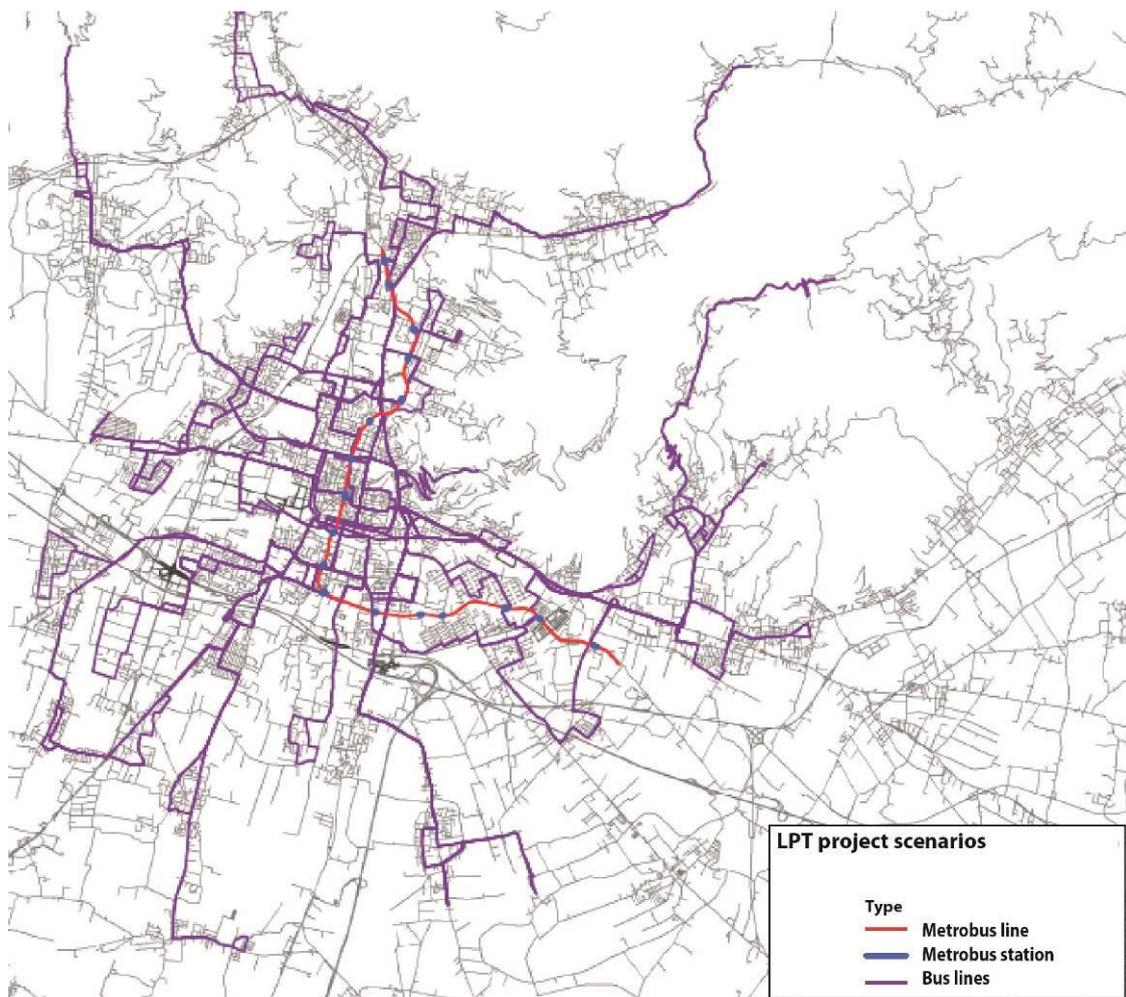


Fig. XXX Scenario B\* - July 2011

## M02.03 – Executive summary

One of the target of Brescia mobility strategy is to increase the use of PT; and in this framework the e-ticketing can give high contribution to enhance intermodality and increase sustainable mobility. The integration of a new electronic cards compatible with NFC (Near Field Communication) standard could improve intermodality services; since up to now intermodality in Brescia urban area was limited only to suburban trips concerning the railways station and the main suburban bus station, located in the same place. Moreover a potential fare integration among public transport companies could be realized by the development of the AFC (Automatic Fare Collection) system, improving even more the accessibility to the whole PT services.

The upgrade of the existing e-ticketing system on Local Public Transport has been then considered fundamental to be implemented before the start up of the new metro line (2013).

The new e-ticketing allows to manage bike sharing, urban bus service and car parking using just one card (i.e. the Omnibus card). So the so-called Omnibus card contributes to give a new “smart “ image of PT in Brescia.

In this framework the measure aimed to prototype a technical solution, feasible from an economic view point, to manage smart cards, allowing users to take advantage of the same support to access the transportation services of the city (metro and buses, bike sharing, car sharing and park and ride), with a new intermodal approach. Thanks to this measure, the opportunity to develop NFC system has also been evaluated.

Research activities have been carried out to study the AFC platform, and, as a result, the new MIFARE contactless card seemed to allow the intermodal approach needed by Brescia.

The distribution of new cards to LPT (Local Public Transport) and bike sharing users allowed the city transport company (Brescia Mobilità) to start the implementation of an integrated e-ticketing system. Consequently, in April 2012 about 1250 cards have already been distributed.

The Measure evaluation has been selected in order to assess:

- possible technological problems related to the use of the new card;
- the magnitude of new card penetration;
- awareness and acceptance level on the integration of different kind of services in the city.

From a technological point of view, it's important to highlight the reliability of the new contactless cards: the number of registered broken cards was less than 2% of all the cards distributed.

To implement a similar measure, it is recommended to pay attention to the feasibility analysis: a strict collaboration with the provider is necessary to develop a suitable technology and make a reliable integrated system. Furthermore, the collaboration among stakeholders is considered fundamental for the measure success. Another key issue is the importance of an effective dissemination campaign (meetings and presentations), in order to spread information throughout the city.

## A. Introduction

### A1 Objectives

The measure objectives are:

(J) High level / longer term:

- To improve the PT accessibility and maximise the potential for local public transport through a fast and convenient service alternative to the private car which allows passengers to use different modes of public transport through the development and the promotion of ITS technologies.

(K) Strategic level:

- To build an optimised and user-friendly environment for high-quality public transport to the benefit of citizens by introducing an integrated ticketing system that can offer passengers a simpler and more seamless way of travelling multi-modally.

(L) Measure level:

- (1). To carry out the necessary research and demo activities in order to prototype and implement a new integrated smart card to be used for the e-ticketing system of the city;
- (2). To purchase and distribute at least 10.000 new MIFARE cards;
- (3). To integrate different transport services in view of the new metro line realization (start up foreseen in 2013), through the e-ticketing system and increase the use of smart cards among PT customers.

### A2 Description

Today contactless technology is part of citizens' daily life. This equipment is a must when high throughput, high validation speed and secure systems are required. It can be used for financial applications, secure access control, secure ID credentials and documents, AFC<sup>5</sup> systems and all RFID<sup>6</sup> applications for supply chain, inventory and item tracking.

Contactless technology is based on an RF (Radio Frequency) communication process. RFID MIFARE 1K card is one of the most popular used for storing memories, while a simple security mechanism divides the memories into segments. Therefore, it is ideal for high volume transactions in all different applications, such as transport ticketing, time attendance solutions, car parking, road-tolling etc. It is mainly used in closed systems as fixed value tickets (e.g. weekly/monthly travel passes).

For these reasons the city of Brescia has decided to carry out research and demo activities in order to prototype and implement an e-ticketing system based on that technology. The ultimate aim by doing that is to strengthen intermodality among different PT modes and vectors, through integrated ticketing systems over wide areas, including different transport services.

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<sup>5</sup> Automatic Fare Collection.

<sup>6</sup> Radio Frequency Identification.

The measure is therefore intended to identify technical solutions ,acceptable from an economic point of view, for managing smart cards avoiding users when travelling by different modes to buy a ticket at each leg of their journey, and so to give them access to different services such as Bike Sharing, Car Sharing and Park and Ride, also in view of the future metro service.

In this context, a new electronic smart card, in line with the ISO 14443 protocol, has been introduced in alternative to the one nowadays in use (GTML Card). Additionally, all the urban bus fleet (230 units) has been equipped with new ticketing machines able to read and validate the new smart card.

With this measure the city of Brescia is also accomplishing the Regional Plan for Intelligent Mobility Development<sup>7</sup> regulation which aims to promote the use of ITS technologies for enhancing the infomobility services to citizens.

In the measure context the opportunity to develop a NFC<sup>8</sup> system has also been considered. In particular, the possibility to apply NFC technology for purchasing tickets and providing infomobility services by using an AFC platform together with the new MIFARE cards has been considered very interesting.

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<sup>7</sup> D.g.r. 27/12/2007-8/6411

<sup>8</sup> Near Field Communication.

## B. Measure implementation

### B1 Innovative aspects

- **Use of new technology/ITS** – This is the first time that a new multiservice smart card – based on ISO 14443 A and B MIFARE card technology – has been introduced in the city of Brescia in order to upgrade the existing e-ticketing system for public transport. The choice of that specific type of card has been made in order to extend the ticketing system also to other urban services such as parking and bike sharing.

This technology is very innovative in Italy, therefore, the definition of the technical features required particular attention from the software supplier.

The potential upgrade of the ticketing system towards NFC technologies represents an innovative opportunity for all PT users (i.e. bus users, Metrobus users besides Park&Ride and Bike Sharing users, adopting an intermodal approach). Additionally, this technology allows to store precious information about PT (Infomobility).

### B2 Research and Technology Development

The research activity has been important to set the technical features of the SW/HW in view of the new e-ticketing system implementation. These activities aimed at improving the existing AFC system for a better customers usability. The SW needed substantial modifications in order to grant the communication between the ticket machines and the new MIFARE cards. It had to modernize the ticket sale devices with contactless interface and to assess the range of services managed by the new cards: Park&Ride, Bike Sharing and the future metro line.

The main research and technology development activities can be summarized as follows :

- Improvement of the contactless reader: specify a remote ticketing board intended to function autonomously, connected to a PC or by a serial link. It allows communication with type A (MIFARE 1) and type B (CD97 travel card, GTML) contactless cards.
- Technical features of the cards' charger devices (MGS-415): the card charger devices and their power supply have been installed in the outlets to upgrade the old type of contact card rechargers. It has been used a new kit (MGS 415) compatible with ISO 14443 A & B standards, and composed by contactless Reader Module CSC<sup>9</sup>, power supply module CSC and power connection RJ45/power. By changing the HW it has been possible to add contactless functionality to the devices to allow a contactless cards recharging since MIFARE technology hasn't got a contact interface.
- Definition of technical features and services to be accomplished by MIFARE contactless new mobility cards;
- Ticket machine software integration for MIFARE cards.

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<sup>9</sup> Content Security and Control.

The new software developed for the purpose has been tested to check the compatibility with the new ISO 14443A standard, maintaining also the previous technology ISO 14443B type. The new standards have also been extended to the electronic ticket machines and the self service machines for the tickets purchase.

The possibility to test an innovative scheme for the e-ticketing NFC applications was carried out through the participation to other projects (such as Stolpan) To reach the goal Consorzio Triveneto, partner of STOLPAN project, was contacted. Consorzio Triveneto had to verify the feasibility of replicating the MIFARE keys to enable communication between validator and cellular phone. A supplier called ACS proposed a bid for the experimentation of a platform able to test NFC technology. Unfortunately the available budget was not sufficient for implementing the experimental phase of the NFC within CIVITAS. Despite that, since the interest in this technology is very high, the basis for the application of NFC to the new ticketing service for the metro line has been investigated during the project lifetime.

### **B3 Situation before CIVITAS**

Before the measure development , intermodality in the urban area of Brescia was possible only for suburban travels by bus and train. The fare integration between different companies was possible only for students travelling from the suburban area and having integrated subscriptions.

For this reason the introduction of a new smart-card able to better integrate the different transport systems from both the technological and the fares point of view resulted to be a key issue for the city. Indeed the existing e-ticketing system (which consisted in a contactless card usable only for Local Public Transport (LPT) services) didn't allow the integration of several services already available in the city,. Additionally, the start-up of the new metro line, foreseen at the beginning of 2013, was a strong driver for the introduction of a new e-ticketing system to allow a PT intermodality.

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: executive design of the AFC system upgrade** (from October 2008 to September 2009) – This stage consisted on RTD activities carried out in order to design the technical features of the new e-ticketing system. The software developer and the new cards supplier were identified and the technical documents for the system upgrade were elaborated. The new designed system consisted of the following main elements:

- **Contactless new smart cards technical features** – The MIFARE cards are of two different kinds: the MIFARE 1K (MF1 IC S50) and MIFARE 4K. The difference between these two cards is the memory capacity. The two types are read by the system in the same way. Since both cards support up to 3 contracts, the decision to use the MIFARE 4K as a 1K card (i.e. a MIFARE 4K card isolating the part of 1K of memory, without using the remaining 3K) was due to the fact that the remaining card memory can be used in the future for other applications such as Car Sharing service.. The MIFARE 1Kmode (as the real MIFARE 1K) is composed of 16 sectors. Each sector consists of 4 blocks of 16KB. Only three sectors can be used, as the 4th block contains the cryptographic keys and access rights. The cards mapping , as defined by the supplier ACS, foresees data divided as follows: Environment, List contracts, 3 contracts, 3 Free Data and 4 events. The cards must be customized to be accepted for sale or validation (mandatory transaction in the system) and the customization should consider both the electronic and the graphic aspect (user's data and photo insertion, DEV – Data End

*Validity definition, printing of the black magnetic line, etc...). Any kind of ticket and fare can be loaded into the card, and each title can be defined as rechargeable or not rechargeable.*

- **Contactless reader improvements** – A remote ticketing board has been set up to work autonomously. The device can be connected to a PC or can have a serial link. It allows communications with type A (MIFARE 1) and type B (CD97 travel card, GTML) contactless cards. In this way, even if simultaneous reading of different types of cards isn't possible, subscriptions can be charged on both types of cards.
- **Cards' charger devices (MGS-415) technical futures** - Card charger devices and their power supply have to be installed in the outlets to upgrade the old type of contact card recharger. With the new contactless charging mode it is possible to charge both the old card GTML and the new MIFARE one. The new kit MGS 415 is compatible with the ISO 14443 A & B standards, and it is composed by contactless Reader Module CSC, power supply module CSC and power connection RJ45/power. The purpose of the hardware changes is to add a contactless functionality to the devices, for contactless cards recharging.
- **Ticket machine software integration for MIFARE cards** – The software upgrade foresees an increase of the maximum number of tickets managed by the Automatic Fare Collection (AFC) system (greater than the old limit of 255 different fares), which is now set up in order to also accept other mobility services (bike sharing, park & ride, metro line tickets).



*Fig.1: Testing instruments for the new contactless cards recharge system. On the left: aerial for the contactless recharge; on the right: printer that simulates the sales check emission*

**Stage 2: Validation test for the software and analysis of SW integration with NFC technology** (from September 2009 to May 2011) – The software developed has been tested for the compatibility with the new ISO 14443A standard, maintaining also the previous technology compatible with the ISO 14443B type. The new standards have been extended also to the electronic ticket machines and the self service machines for tickets purchase.



Fig.2: Updated the software running on the ticket machines for the contactless control of the validity of the cards



Fig.3: Updating of the software running on the ticket self service sales machines

During this stage the possibility to open the system to NFC technology was investigated, by searching potential partners for participating to other European projects (such as STOLPAN) or co-funding programmes to obtain the needed funds to develop such technology. Additionally, the ACS supplier has been contacted in order to make a feasibility study for an NFC trial, based on an emulation of the operations made with MIFARE cards on mobile devices like Nokia 6212.

with reference to the STOLPLAN project contacts with Consorzio Triveneto have been carried out for exploring the feasibility of replicating the MIFARE keys to enable communication between validators and cellular phone. In parallel, a search for co-funding negotiations have been held among BSM, bank and mobile phones operators. As the available budget is not sufficient for the actual

implementation of the NFC technology, just the basic research activities for the application of NFC to the new ticketing service for the metro line has been investigated.

Three different scenarios have been defined as possible ones because linked with Secure Element adopted, namely:

- SIM BASED Secure Element;
- External Secure Element (SDD CARD);
- Chip Embedded Secure Element.

The SIM BASED scenario was chosen because public transport is an example mass market and mobile phones that are based on a SIM technology (that would allow secure payments) could be easily adapt to do payments trough their SIM.

The main problem isn't technological but is related to customers' privacy and to SIM secure protocol, therefore an agreement with phone providers should be carried out.

Concerning the intermediate running phase, the proposition of Secure Element on SDD has been considered interesting. This kind of solution can allow the independence among the external elements and simplify the reference Business Model, minimizing the number of involved operators. Nevertheless, this solution has been considered not strong enough to start the Mass Market.

As third option, it has been taken into account the Chip Embedded solution since it is available both in Android system and Samsung one. Anyway, the system access isn't available with Open modality. Hence, even if the solution has been considered interesting it sets some objective problems to make the system working,. Therefore, this solution has been discarded because of the close examination impossibility.

In case of SE on SDD application, the model is shown in the following diagram (Figure 4):

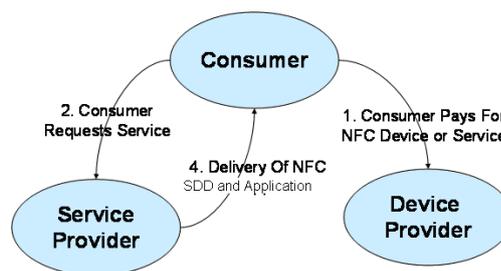


Fig. 4: High Level Commercial Model

In case of SE SIM BASED application, the model is more complex, as shown in the next diagram (Figure 5):

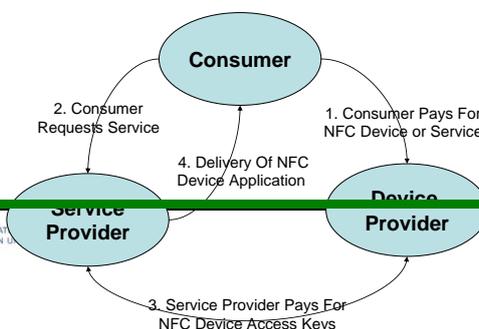


Fig. 5: High Level Commercial Model

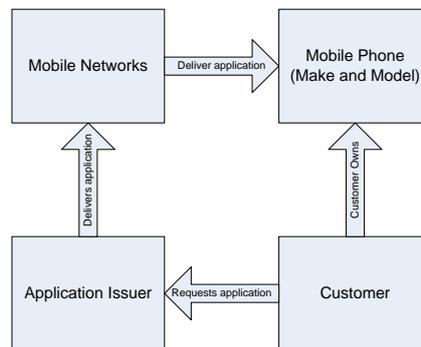


Fig. 6: Mobile NFC Operational Delivery Model

Therefore, the most important step came out to be the need of establishing an agreement with a mobile operator.

After an initial research phase, the option of using a phone with Secure Element Embedded has been dismissed: because not suitable to Market Model development.

As regards the SIM BASED solution, the alternative to implement a test phase with Telecom Italia phone operator has been analyzed. This choice was taken because this operator was already following an ambitious Road Map, including also the start-up of NFC service addressed to the Mass Market.

As regards the SDD Card solution, many marketed products have been analyzed and it has been chosen to collaborate with WatchData, already used in France for similar projects.

The testing phase has been carried out in order to demonstrate the compatibility between the ticketing system in place in Brescia and NFC technology. In this phase, the priority has been given to the interaction between the chosen depot/SIM and the systems in place in Brescia and not to the "OTA" phase of NFC services. In order to carry out the testing phase, Secure Elements have been customized before the deployment on field. The USE CASES foreseen for the testing phase are explained below.

- Ticket purchase: the phone interacts with the existing system.
- Ticket validation: the ticket is used as in case of electronic equipment.
- Control: the phone is used as electronic ticket and it's controlled with the system in place.
- Visualization of ticket through phone User Interface: users, with USER INTERFACE, verify their ticket.

Nowadays, the more suitable technology for NFC system is the SIM based one.

this because it foresees that the chosen system Device + SIM emulates the MIFARE Classic card with the ticketing system.

During the design/planning phase the involved operators accomplished the following tasks:

- Brescia Mobilità provided:
  - o MIFARE keys in the ticket testing field;
  - o Layout of tickets on the card.

- *Consorzio / TELECOM provided:*
  - *Set up SIM;*
  - *Mobile phone useful for testing phase;*
  - *Specifications SW application;*
  - *SW application for Mobile system.*

*During the testing phase the involved operators realized the following tasks:*

- *Brescia Mobilità and TELECOM agreed on management process of production keys;*
- *Consorzio / TELECOM provided:*
  - *Production SIM;*
  - *Phones.*
- *Brescia Mobilità:*
  - *Identified target users;*
  - *Planned the testing phase.*

**Stage 3: Experimental project / Prototyping test** (from /June 2011 to October 2012) – *This stage started with the arrival of the new multi-service cards ( May/June 2011). As the new cards have already been integrated with the Bike Sharing service, the priority has been to distribute the cards to the Bike Sharing users, in order to accelerate the activation of the new ticketing system (the new cards were sent to the subscribers by post). While the distribution of the cards to the LPT and Parking subscribers was more gradual and registered a massive increase in occasion of the season tickets renewal in September (school opening).*

# MOBILITÀ



La mobilità si appoggia nell'ambito del progetto Civitas Modern di Comune e Gruppo Brescia Mobilità

## Muoversi in città con Omnibus una card che fa per quattro

La tessera di Brescia Mobilità per sosta e trasporto pubblico valida in autobus, ai parcometri, nei parcheggi e su Bicimia

Al volante, in autobus, in sella alla bicicletta, la chiave d'accesso alla mobilità bresciana da oggi è una sola. Si tratta disponibile già dai punti di ritiro la nuova Omnibus card di Brescia Mobilità, la tessera unica per viaggiare con il trasporto pubblico sul territorio urbano e sostare nei parcheggi a pagamento della città. Rappresenta un punto di incontro di viaggio, in sostituzione delle quattro vecchie tessere abbonamento per i diversi servizi (continuavano invece a funzionare le vecchie tessere tradizionali card per il servizio autobus urbano, quest'ultima ai cittadini di servizio offerto dagli autobus di linea, dai parcometri, dai parcheggi di struttura, di strada e, nell'area di sosta, erano anche del servizio in auto più comodo e funzionale, specificamente per i possessori di Bicimia).

**IL PRESIDENTE** dell'Ente alla mobilità garantisce anche attraverso un servizio facile, immediato, comodo e funzionale.

### DOVE TROVARLA

Dall'infopoint alle casse, 4mila quelle spedite a casa

Si chiama «omnibus» il tipo di tecnologia utilizzata dalla nuova Omnibus card. Una card di metallo di piccole dimensioni, con la capacità di memorizzare dati e informazioni di pagamento e di identificazione. La tessera si riceve in un punto di ritiro già nei prossimi giorni. Per i cittadini che preferiscono ritirarla in un punto di ritiro, come i parcometri o la struttura della città, alle casse di Delecia. Tra i punti di ritiro ci sono i punti di Brescia Mobilità. Qui, quindi, invece di un punto di ritiro, tutti i servizi sono a portata di mano. La card sarà spedita a fronte di una causale di 5 euro, valida per il caso di ricezione da parte del cliente. Il servizio è gratuito. Valida il 50% di sconto sui servizi di parcheggio e di sosta. Il servizio è valido per il primo 4.000 euro di spesa e per il resto al 50% di sconto.

### DOVE USARLA

**IN AUTOBUS**  
La nuova card potrà essere usata su tutti gli autobus del trasporto pubblico urbano, con la stessa modalità del vecchio abbonamento elettronico.

**AL PARCOMETRO**  
Al parcometro la tessera funzionerà anche come parcometro. Il credito verrà scalato facendo scattare la tariffa applicativa nel secondo lotto.

**IN PARCHEGGIO**  
Anche nei parcheggi a pagamento la tessera funzionerà come parcometro.

**CON BICIMIA**  
Gli abbonati al servizio di noleggio in città di Bicimia, potranno utilizzare per girare sulle due ruote il servizio.

### L'ASSESSORE

**Fabio Rolli**

### Un primato per la mobilità sostenibile

Conoscendo la facilità d'accesso «che semplifica la vita all'utente e rende più fruibile la mobilità cittadina». Sono questi i punti forti che Fabio Rolli, vicesegretario amministrativo della Mobilità, ha individuato tra le potenzialità del supporto integrato per i titoli di trasporto pubblico «Omnibus card». Lo sviluppo è stato realizzato nel progetto Civitas, opera Brescia, con gli altri comuni aderenti al progetto in tutto il territorio nazionale e tra le novità proposte più all'avanguardia per i cittadini e la città che concretamente il supporto integrato per i titoli di trasporto pubblico «Omnibus card» che attraverso strumenti pratici e concreti, «inoltre» degli interventi di sensibilizzazione e della volontà di modernizzare che si rivelano fondamentali, se non indispensabili, anche per il futuro del trasporto.

## La card apre le porte al futuro

Prignani: ora guardiamo ai nuovi servizi

Il frutto di un lavoro che ha richiesto molti sforzi, proprio perché da un punto di vista organizzativo e di tecnologia, è un risultato che vale il tempo investito. Questa è la parolaccia di Marco Medaglia, direttore generale di Brescia Mobilità, Brescia Trasporti e Sines, nella presentazione ufficiale, alla sede di Brescia Mobilità, del nuovo supporto integrato. Al tavolo anche i presidenti delle società del gruppo: l'ingegner Giancarlo Prignani, sindaco di Brescia, il presidente di Sines - non solo ai servizi che gli sono stati, ma anche per le proposte che avventurano i professionisti. La card elettronica è un servizio innovativo e moderno, che apre le porte al futuro. Il servizio di trasporto, compresi quelli che verranno offerti nei prossimi mesi, aggiunge Valerio Prignani, presidente di Brescia Mobilità. L'obiettivo, spiega Andrea Cervoni, presidente di Brescia Trasporti, «è quello di offrire ai cittadini gli strumenti per avere in mano, in modo agevole e immediato, il titolo di viaggio».



Il presidente Prignani su un treno del metrò

Fig. 7: Promotion of the new cards on local news papers (Giornale di Brescia, 05/07/2011)



Measure title:

**DEVELOPMENT AND UPGRADE OF THE E-TICKETING SYSTEM IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **02.03**



## C. Evaluation – methodology and results

From the evaluation point of view the main objective of the measure consists in prototyping and implementing the e-ticketing system in Brescia and monitoring its use.

### C1 Measurement methodology

The indicators have been divided into two macro categories: main indicators and complementary indicators.

Main indicators are able to evaluate measure efficiency in terms of objectives achievement. Complementary indicators, instead, are introduced in order to assess specific issues. These indicators are relevant only at local level and are used to give additional information to better understand the measure performance.

For each measure, the two indicator categories have been specified together with the indicators that have been eventually deleted because no more significant in the light of the measure evolution.

In this measure all indicators are considered as main ones, because they are strictly linked to the achievement of the targets at measure level (see paragraph A1).

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators**

No.	Impact	Indicator	Data used	Comments
1	Economy	Average cards validation per month	e-ticketing database	Main Indicator First data collection OCTOBER 2011
2	Economy	Number of new cards distributed in a given time period	e-ticketing database	Main Indicator Ex ante not scheduled First data collection OCTOBER 2011
3	Transport	Number of new cards validated/ Total number of new cards	e-ticketing database	Main Indicator Ex ante not scheduled First data collection OCTOBER 2011
4	Transport	Number/kind of fares/season tickets loaded on the new cards respect to the number of distributed new cards	e-ticketing database	Main Indicator Ex ante not scheduled First data collection OCTOBER 2011
5	Transport	Number of card breaks/new cards distributed	e-ticketing database	Main Indicator Ex ante not scheduled First data collection OCTOBER 2011
6	Society	Awareness level	Customer satisfaction survey	Main Indicator First data collection ...
7	Society	Acceptance level	Customer satisfaction survey	Main Indicator First data collection ...

Detailed description of the indicator methodologies:

- **Indicator 1 (AVERAGE CARDS VALIDATION PER MONTH)** – The existing ticketing system consists of two kinds of tickets: contact-less cards (for the season ticket holders) and the magnetic tickets (for occasional users). As the measure consists in distributing new contactless cards (MIFARE), this indicator is measured using data referred to the contactless cards validation. The indicator is collected monthly and it's calculated dividing the total number of c-less validations by the total number of valid season tickets. More details can be found in the specific section “Annex 2”.
- **Indicator 2 (NUMBER OF NEW CARDS DISTRIBUTED IN A GIVEN TIME PERIOD)** – This indicator is built considering the number of new MIFARE cards distributed for the local PT service in a given time period.
- **Indicator 3 (NUMBER OF NEW CARDS VALIDATED/ TOTAL NUMBER OF NEW CARDS)** - The methodology is similar to the indicator 1 “Average cards validation per month” (built dividing the number of validations by the number of active season tickets), data are referred to the new MIFARE cards distributed for the LPT service.
- **Indicator 4 (NUMBER/KIND OF FARES/SEASON TICKETS LOADED ON THE NEW CARDS COMPARED WITH THE NUMBER OF DISTRIBUTED NEW CARDS)** - In order to investigate the intermodality attitude of the LPT subscriber, this indicator is built extracting from the e-ticketing database the number of users that activated, besides the local PT season tickets, also the bike sharing service, which can be loaded on the same card.
- **Indicator 5 (NUMBER OF CARD BREAKS/NEW CARDS DISTRIBUTED)** - This indicator is useful to evaluate the new cards performance/reliability, as for many reasons cards can break and must be replaced. Data recorded are not lost but must be reactivated on a new card. E-ticketing database is able to monitor the number of cards that have been replaced and this information is compared with the total number of new cards distributed.
- **Indicator 6 (AWARENESS LEVEL)** - This indicator (and indicator n. 7 “Acceptance level”) is calculated through the BST Customer satisfaction inserting specific questions to the conventional survey, namely:
  - ✓ Do you know that a multi-service card (able to manage, beside local PT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?

The results of the survey can be found below, under the section “Annex 2”.

- **Indicator 7 (ACCEPTANCE LEVEL)** - This indicator (as indicator n. 6) is calculated through the BST Customer satisfaction inserting specific questions to the conventional survey, namely:
  - ✓ Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro)? Would you be favourably disposed towards the payment of a symbolic 5€ key money?

The results of the survey can be found below, under the section “Annex 2”.

## C1.2 Establishing a Baseline

Since the beginning of the 21st century the city of Brescia has been characterized by an integrated management of the local public transport. Progressively, also the parking service and other complementary activities, such as the traffic lights management and the violations control (multaphot and multanova) have been added to the integrated management.

Brescia Mobilità SpA (metropolitan mobility company – BSM) was born on 28th December 2001, after the divestiture from the original Company ASM Brescia Spa.

Brescia Mobilità Company structure includes the following services and sectors:

- Public Transport (Brescia Trasporti SpA);
- Parking and parking meters (Sintesi);
- Traffic lights and innovative technologies;
- Driverless light metro (Metrobus).

The most important objective of the Brescia Mobilità Group is planning and managing different activities regarding mobility according to the Municipality's strategies and policies,.

One of the activities carried on by BSM is the management of both single and seasonal tickets system (concerning the LPT, parking, etc.).

The situation to be taken as reference for the baseline consists in a local PT ticketing system based on 2 different kinds of tickets: the magnetic tickets (for the occasional users) and the contactless tickets (for the systematic users who subscribe a season ticket). Before Civitas, for the systematic users a ticketing system based on the contactless technology was already available in Brescia (since 2003). These c-less tickets were able to manage only the bus service season tickets.

The implementation of new mobility services (first of all the future metro line), offered the opportunity of upgrading the electronic ticketing. Before the start up of the metro line (December 2012); the new technology introduced by the measure represents a valid tool able to significantly test the new card potential towards the future intermodal mobility attitude of the city.

The design of the new cards ended at the beginning of 2011, as the necessary technology was developed by that period. The distribution of the new cards started in July 2011 among the bike sharing subscribers. The distribution of the cards to the LPT and parking users started later and was characterized by a gradual diffusion, as it depended also on the season tickets renewal .

The time reference for the establishing of the indicators baseline is July 2011, except for indicators n.6 (Awareness level) and n.7 (Acceptance level) which derive from the results of the customer satisfaction survey made in May 2011.

Indicator 1 (Average cards validation per month, intended as the total number of validations on bus divided by the LPT valid season tickets per month) has been selected to monitor the use of cards in the local PT network (i.e., for the baseline, the already existing contactless cards and then also the new MIFARE contactless cards after their introduction during Civitas). The baseline value (ex-ante) for this indicator, referred to July 2011, is equal to 29,39.

Since the new cards have been developed during the measure implementation, for the indicators n. 2 (Number of new cards validation in a given time period), n.3 (Number of new cards validated/ Total number of new cards), n.4 (Number/kind of fares/season tickets loaded on the new cards compared

with the number of distributed new cards) and n.5 (Number of card breaks/new cards distributed), about the new cards performances, the baseline value is equal to 0.

Even if also indicators n.6 and n.7 are referred to the new cards, they have a baseline value different from zero because they measure the level of information about the new cards distribution (i.e. the level of awareness and acceptance) among the citizens.

Indicators	BASELINE (July 2011)
1. Average cards validation per month (total validations on bus/ LPT valid season tickets per month)	29,39
2. Number of new cards validation in a given time period	0 (no service)
3. Number of new cards validated/ Total number of new cards	0 (no service)
4. Number/kind of fares/season tickets loaded on the new cards compared with the number of distributed new cards	0 (no service)
5. Number of card breaks/new cards distributed	0 (no service)0
6. Awareness level (May 2011)	5,1 % of the interviewed people are aware of the imminent distribution of the new card in Brescia
7. Acceptance level (May 2011)	26 % of the interviewed people are interested in the new card;  22,1 % of the interviewed people are disposed to pay 5€ key money for the new card

### C1.3 Building the Business-as-Usual scenario

To build the BaU scenario for selected indicators, different approaches have been adopted.

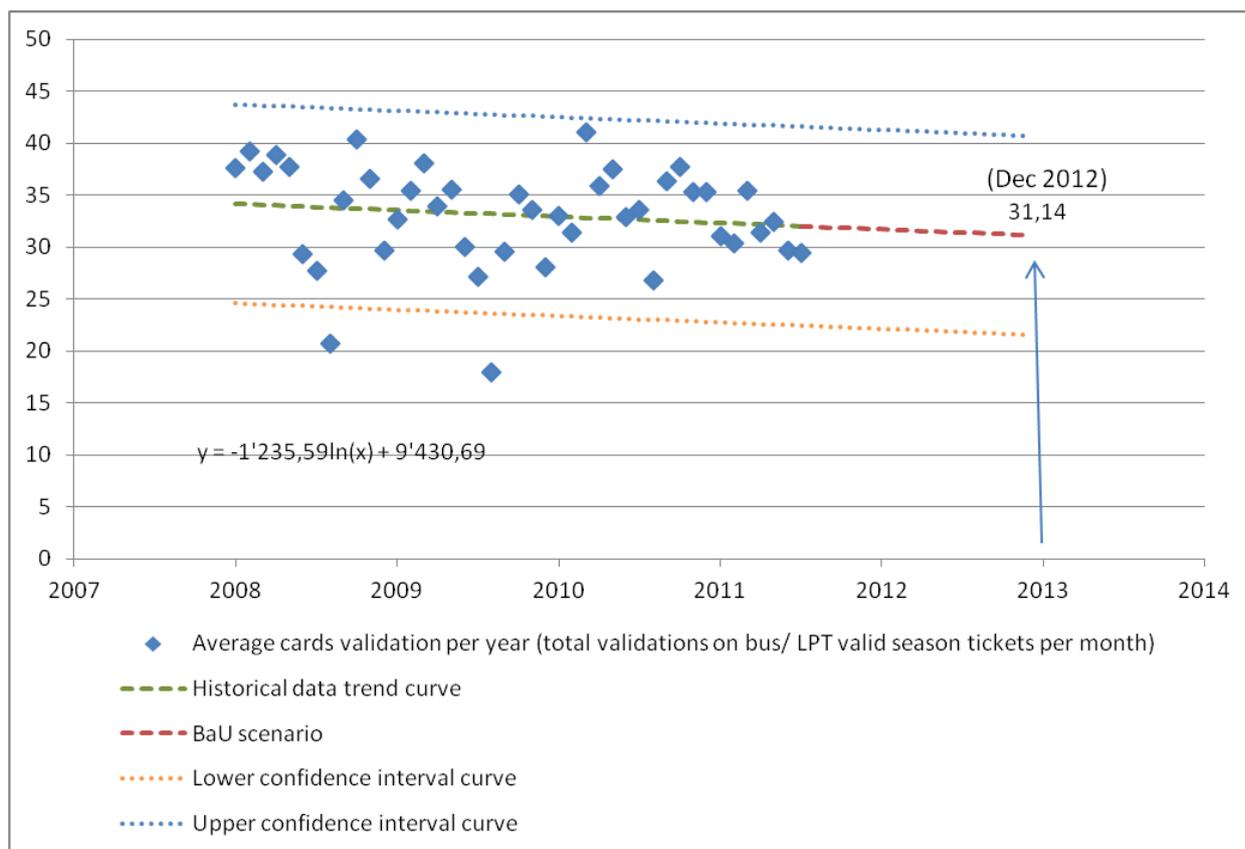
For the indicator n.1 “Average cards validation per month” (total validations on bus/ LPT valid season tickets per month) a consolidated monthly data series were available (since January 2008). Therefore, the BaU scenario for this indicator has been obtained projecting the historical data series (see the graph 1 BaU of Average cards validation per year).

The time horizon for the BaU scenario is December 2012, just before the start up of the metro service in Brescia.

The obtained BaU value for December 2012 (31,14) demonstrates an increasing trend with respect to the Baseline value. The introduction of the new e-ticketing system during Civitas should increase the value of this indicator, and the running of the metrobus, during 2013, will probably amplify this trend even more, also considering that the new card will be fully used for intermodality purposes.

Before the end of Civitas the integration among services will not be complete.

As a matter of fact, the metro service and the interchange parking will be working only after the beginning of 2013. Furthermore, it's important to highlight that the increase of the bike sharing stations is foreseen and these new ones will be installed near each metro station.



**Graph 4 – BAU of Average cards validation per year**

Indicators	BaU scenario (December 2012)
1. Average cards validation per month (total validations on bus/ LPT valid season tickets per month)	31,14

The assumptions concerning the BaU scenario for the indicators n.2 (Number of new cards validation in a given time period), n.3 (Number of new cards validated/ Total number of new cards), n.4 (Number/kind of fares/season tickets loaded on the new cards compared with the number of distributed new cards) and n.5 (Number of card breaks/new cards distributed), have been based on the new cards performances, taking also into consideration the ideas exposed in the interview with Brescia Mobilità SpA General Director, made by the Local Evaluation Group of Brescia in July 2011. The interviewee highlighted the crucial importance of the Civitas contribution in the realization of the new contactless cards. Indeed, without CIVITAS, this activity wouldn't have been implemented before the start up of the metrobus due lack of resources. For this reason the Business as Usual scenario has been set as equal to the Baseline value (0), since it corresponds to the alternative zero or the so-called “do nothing” option. As a consequence, notwithstanding the presence of a baseline value, also the BaU scenario for indicator n.6 (Awareness level) is equal to 0.

Concerning the indicator n.7 (Acceptance level) – being set in order to better understand the interest in the possible new card in relation with the start up of the metro – its value has been considered equal to the baseline (26% of the interviewed people are interested in the new card, 22,1% of the interviewed people are disposed to pay 5€ key money for the new card).

Indicators	BaU scenario (December 2012)
2. Number of new cards validation in a given time period	0 (no service)
3. Number of new cards validated/ Total number of new cards	0 (no service)
4. Number/kind of fares/season tickets loaded on the new cards compared with the number of distributed new cards	0 (no service)
5. Number of card breaks/new cards distributed	0 (no service)
6. Awareness level	0 (no service)
7. Acceptance level	<p>26 % of the interviewed people are interested in the new card;</p> <p>22,1 % of the interviewed people are disposed to pay 5€ key money for the new card</p>

## C2 Measure results

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

### C2.1 Economy

**Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”**

Indicator	Before	B-a-U	After	Difference: After –Before	Difference: After – B-a-U
1. Average number of validations per month	July 2011 = 29,39	October 2011 = 31,85	October 2011: 28,34	-1,05	-3,51
		April 2012 = 31,55	April 2012: 27,94	-1,45	-3,61
2. Number of new cards distributed in a given time period	Not scheduled	October 2011 = 0 (no service)	October 2011 = 690	Not Assessable	+690
		April 2012 = 0 (no service)	April 2012 = 1251	Not Assessable	+1251

As regards the average number of validations per month, collected by indicator 1, the "BaU" value is higher than the “After” one.

This reduction is due to:

- the increase of the LPT ticket fares during Civitas Project, which wasn't considered in the BaU fulfilment (as the fare influence on the “Average number of validations per month” is usually considered a transitory condition)
- the reduction of the LPT passengers in Brescia (from 42.692.823 passengers in 2008 to 42.553.535 passengers in 2010) that is related to the economical crisis, which caused the closing down of many activities in Brescia

This inflection cannot be considered related to the new implemented technology.

### C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category “Transport”**

Indicator	Before	B-a-U	After	Difference: After –Before	Difference: After – B-a-U
3. Number of new cards validated/ Total number of new cards	Not scheduled	October 2011 = 0 (no service)	October 2011: 8,18	Not Assessable	+ 8,18
		April 2012 = 0 (no service)	April 2012: 16,12	Not Assessable	+ 16,12

Indicator	Before	B-a-U	After	Difference: After –Before	Difference: After – B-a-U
4. Number/kind of fares/season tickets loaded on the new cards compared with the number of distributed new cards	Not scheduled	October 2011 = 0 (no service)	October 2011: 20,14%	Not Assessable	+20,14%
		April 2012 = 0 (no service)	April 2012: 18,86%	Not Assessable	+18,86%
5. Number of card breaks/new cards distributed	Not scheduled	October 2011 = 0% (no service)	October 2011: 0/690 = 0%	Not Assessable	0%
		April 2012 = 0% (no service)	April 2012: 18/1251 = 1,44%	Not Assessable	+ 1,44%

As regards the ratio between the number of new cards validated and the total number of new cards, an increase of the collected values can be observed, in spite of the results of indicator 1 (Average number of validations per month). It can demonstrate that the new card is well accepted and it works.

As regards the use of the new card as integrated support, considered through indicator 4 (Number/kind of fares/season tickets loaded on the new cards respect to the number of distributed new cards), the collected values are considered almost constant.

It's important to remark two aspects:

1. up to 2013, mainly bike sharing and LPT can be considered as “chargeable services on the new card”, because these services at the moment represents the actual intermodal offer;
2. the parking subscriptions can be charged on the new card, but, until the start up of the metro by 2013, their use cannot be considered finalized to intermodality.

An increase of the value of the indicator 4 is expected in the near future, considering the start up of the metro by 2013.

Moreover, the new card durability, evaluated through indicator 5 (Number of card breaks/new cards distributed) is considered satisfactory: as a matter of fact, the number of broken cards is reasonably low in comparison with the total number of distributed cards. The new technology is considered reliable from the technical point of view.

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category “Society”**

Indicator	Before	B-a-U	After	Difference: After –Before	Difference: After – B-a-U
6. Awareness level	May 2011: 5,1 %	November 2011 = 0 (no service)	November 2011: 44,3 %	+ 39,2%	+ 44,3 %
7. Acceptance level	May 2011 (interest in the new card) = 26 %	November 2011 (interest in the new card) = 26 %	November 2011 (interest in the new card) = 22,6 %	- 3,4%	- 3,4%

Indicator	Before	B-a-U	After	Difference: After –Before	Difference: After – B-a-U
	May 2011 (willing to pay 5€ key money for the new card) = 22,1 %	November 2011 (willing to pay 5€ key money for the new card) = 22,1 %	November 2011 (willing to pay 5€ key money for the new card) = 88,9 %	+ 66,8%	+ 66,8%

In order to evaluate the awareness and the acceptance of citizens about the new integrated card, some specific questions have been added to the standard customer satisfaction survey.

Before the distribution of the new e-ticketing card, the specific questions for indicator 6 and 7 were:

*"Do you know that a multi-service card (able to manage, beside local PT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?"*

*"Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro)? Would you be favourably disposed towards the payment of a symbolic 5€ key money?"*

These questions have been updated after the card distribution: the first question changed in "...have been distributed?", while the second one hasn't been changed.

The comparison between "Before" and "After" situations shows a significant increase of the awareness level towards the new cards, but at the same time a very slight decrease of the acceptance.

It's important to highlight that in the customer satisfaction survey the sample size of the interviewed people was the same, but the involved people were different and no specific information campaign was carried out just before the interviews.

Therefore, the growth of citizens' awareness and acceptance seem to be related to satisfied users - that spread out the information through "word-of-mouth" - and to dissemination campaigns carried out during mobility events in Brescia, such as the European Mobility Week.

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	To carry out the necessary research and demo activities in order to prototype and implement a new integrated smart card supporting the e-ticketing system in Brescia The objective is considered exceeded.	**
2	To purchase and distribute at least 10.000 new MIFARE cards. The objective is considered substantially achieved..  <i>The achievement can be evaluate considering both the purchase and the distribution of new cards.. The distribution activity is expressed by indicator 2 (Number of new cards distributed in a given time period). In April 2012 the distributed cards were equal to 1.251, as part of the 7.333 cards available. The number includes also the new distributed cards for other interoperable services, such as Trenocittà, ioviaggio Lombardia and SIA bus network. As regards the purchased cards, their number exceeded the 10.000 cards (actually, more than 6.000 cards have been distributed among bike sharing users, more than 1200 among PT users and 5.000 have been given to the suburban transport societies to distribute among interested users</i>	*
3	To integrate different transport services in view of the new metro line realization	**

	<p>(start up foreseen in 2013), through the e-ticketing system and increase the use of smart cards among PT customers . The objective is considered achieved in full.</p> <p><i>The achievement can be evaluate considering that on the new MIFARE card the subscription of bicimia, LPT service and parking service can be charged. The metro service will start up with the new technology and subscription will be immediately chargeable.</i></p>	
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full            *** = Exceeded</b></p>		

## C4 Up-scaling of results

The measure implementation regarded all the urban and suburban territory not only for LPT service (considering that the service coverage of the territory regards the city of Brescia and 14 suburbs around Brescia), but also for bike sharing and parking (all the small columns in these service have been equipped with the new validation support, updated for the new card). Therefore it isn't possible to make an up scaling of the results of the measure, as all the potential and the existing users and areas have been already involved in Civitas Project activities.

## C5 Appraisal of evaluation approach

The evaluation approach firstly considered project's objectives as expressed explicitly in the original evaluation plan. The data collection methodology and the data quality have been defined as adequate for the technical evaluation of the measure.

The indicators were selected at the beginning of Civitas project and the chosen ones belong to the following categories: Economy, Transport and Society. Indicators were able to monitor the attitude to the use of LPT service in Brescia and the effective distribution of the new integrated card, developed during Civitas. The indicator 2 ("Number of new cards distributed in a given time period") were useful to evaluate research and demo activities at measure level

The indicators included in the category "Transport" were useful to evaluate the use of the new integrated card on LPT service (through both indicator 3 "Number of new cards validated/ Total number of new cards" and indicator 4 "Number/kind of fares/season tickets loaded on the new cards respect to the number of distributed new cards") and the durability of the card (through the indicator 5 "Number of card breaks/new cards distributed"). This indicator was considered important in order to monitor the reliability of the new contact less card and, as a consequence, of the intermodality in Brescia. At the beginning of Civitas project, these indicators were chosen in order to monitor technological problems and to give an order of magnitude of the measure implementation.

The indicators within the category "Society", were used to monitor Awareness and Acceptance of the new card. It was considered significant to insert specific questions in BST Customer Satisfaction conventional survey. This choice was carried out because of the novelty of the new integrated card.

The ex ante and ex post data collections have been carried out as defined in the original plan.

This measure is part of "Metro package", with measures M02.02 "Intermodality with public transport", M03.03 "P&R facilities for underground and public transport systems in Brescia" and M08.05 "Brescia Mobile Channel". In order to carry out a complete evaluation, it's important to consider these measures in the context of the city of Brescia, which is deeply changing with the metro start up by 2013. In this view, the evaluation approach was affected by the need to obtain an overall perception of the Metro Package implementation.

## C6 Summary of evaluation results

The key results are as follows:

- **Key result 1** – It's considered significant that in a medium sized city, as Brescia, it has been decided to improve the existing e-ticketing system with a new integrated contactless card,

technologically advanced. This choice, also linked with the start up of the metro line in the city, was important for the city image, in terms of “city smartness”.

- **Key result 2** – The realization of a new prototype of an integrated contactless ticketing system in Brescia has been an important goal from a technological point of view, because the validation of only one card allows to use different transport systems (LPT, metro, Bike sharing, car parking and Park & Ride). The system is the development of the existing one, which was not integrated (there is one card for each service). This choice will be more esteemed after the start up of the metro (2013).
- **Key result 3** – The new cards distributed for LPT were almost 1250 in April 2012. These were in addition to the 6000 cards distributed to bike sharing users. The new system implementation has increased the awareness level about the new card and the opportunity of integrated mobility (from ex ante data 5,1% of interviewed people to ex post data 44,3%) and the acceptance level (from ex ante data 22,1% to ex post data 88,9% referred to interviewed people who have been willing to pay a caution for the new integrated card).
- **Key result 4** – From a technological point of view, it's important to underline the reliability of the new contactless card: actually, the number of registered broken card have been less than 2% of all the distributed cards.
- **Key result 5** – During Civitas project, a substantial decrease of the number of all LPT card validations has been registered. Otherwise, the number of the contactless card validations have increased during the operational phase. Therefore, the new e-ticketing cards have been accepted and they have been daily used.

## C7 Future activities relating to the measure

Among the possible future activities related to the measure, which can be carried out after the end of Civitas, the control and the monitoring of the information security on the new integrated card are the most important ones from a technological point of view. Furthermore, the monitoring of the number of new cards breaks and the number of new cards validations will also be important to control both if the dissemination campaign carried out till now is sufficient and if the new cards don't have any technological problem (paying particular attention to the new cards obsolescence).

Other future activities will consist in a promotional campaign, in view of the metro start up in order to spread out information about the new integrated card. Furthermore, it will be important to inform citizens about the opportunity of charging the new card with the metro subscription, to increase awareness and acceptance level in Brescia about available integrated mobility systems. Furthermore, a massive distribution of the new integrated cards is likely possible, in order to promote the new integrated transport service in Brescia.

As regards the NFC technology experimentation, it's foreseen to draw up the necessary security protocols for the SIM cards and also to activate an agreement with Triveneto consortium.

## D. Process Evaluation Findings

### D.0 Focused measure

This measure is not a focused one.

### D1 Deviations from the original plan

- **NFC technology deviation** – as regards the initial project, an important deviation, which has to be pointed out, is linked with the test phase on NFC technology. As a matter of fact, as it has been described in section B4, the activities carried out are related to a test phase in Autumn 2012. The delay of this phase is due to the difficulty to make agreements with phone partners, in order to test the new technology that is SIM based.

The technological development was also more difficult than expected because the fares plan, foreseen to make them flexible.

### D2 Barriers and drivers

#### D2.1 Barriers

In the sequel main barriers, which have been picked out during the measure implementation, are pointed out:

##### Preparation phase

- **Planning barrier** – there were some difficulties in the project technical management to determine requirements of measure implementation for NFC technology experimentation (times to make technical and economic arrangements with different partners have been undervalued)

##### Implementation phase

- **Organizational barrier** – during the first phase of the measure implementation, it has been pointed out a problem related to the monopoly of card validation system, which has contrasted with the measure implementation (development of a new integrated card).
- **Technological barrier** – there were some problems related to the availability of Smartphone with NFC enabling. As a matter of fact, this system would allow to pay fares with a Smartphone.

##### Operational phase

- **Organizational barrier** – the collaboration between Brescia Mobilità and Brescia Trasporti in order to distribute the card was insufficient. This is considered a company barrier, that didn't compromise the defined objectives achievement of the measure. In fact, the delivery of 10000 cards was fulfil: cards were delivered to bike sharing users, to parking users and to public transports users, who expressly required the new card (Omnibus). Brescia Trasporti chose to use the old cards only for public transport users and new cards (Omnibus) for multiservice users.

## D2.2 Drivers

In the sequel main drivers, which have been picked out during the measure implementation, are pointed out:

### Preparation phase

- **Political and organizational driver** – a constructive partnership was arranged in order to develop a new mobility card for the citizens among Brescia Mobilità, Sintesi (parking management) and Brescia Municipality.
- **Strategic barrier** – considering the necessity to realize a new ticketing system, in the view of the start up of the metro (2013), and the possibility to improve the existing intermodal attitude of citizens, Civitas project has been considered an important occasion to implement both the new e-ticketing system and the interchange among transports offered by the city of Brescia, through not only new infrastructure (as new parking for P&R), but also through a new contactless card with several integrated services.

### Implementation phase

- **Financial driver** – the availability of Civitas funding was fundamental for developing the electronic ticketing system upgrade, also in the view of the start up of the metro, foreseen in 2013.

### Operational phase

- **Political/strategic driver** - Considering that this measure is linked with the start-up of the metro, a Target Group has been created (see Annex 3), , in order to make more sharable the objectives of each measure related to the so-called ‘metro package’ (M02.02 “Intermodality with public transport”, M03.03 “P&R facilities for underground and public transport systems in Brescia”, M08.05 “Brescia Mobile Channel”). MLs had taken part in the target group in order to discuss and to concert the activities, which had to be carried out. In particular, the meeting was important at measure level, because it was possible to discuss the typology of analysis which was needed to carry out the use of the new card and the different services to be used. Furthermore, it was possible to consider the activities for the card distribution, in order to optimize the spread of information and of the card itself.

## D2.2 Activities

### Preparation phase

- **Planning activity** - As regard the NFC technology, some activities have been carried out in order to start the test phase before the end of Civitas, according to several involved stakeholders, and a proposal of an agreement has been arranged between ML and the phone partner. Both partners agreed in carrying out research in order to shift from the test phase to the implementation one in short time.

### Implementation phase

- **Organizational activity** - during the measure implementation, it has been arranged an agreement between Brescia Mobilità card validation system society in order to update the validation system, which was considered inadmissible for the Brescia Mobilità new needs. It has been possible only thanks to a strict collaboration between the societies.

### Operational phase

- **Political/strategic activity** - in order to get over the political/strategic barrier, a constructive partnership was arranged in order to develop a collaboration to the objective achievement, through a strict collaboration with MLs. Furthermore, it has been arranged an important partnership between BST and BSM, in order to solve problems related to the new card distribution.

## D3 Participation

### D.3.1 Measure partners

- **Brescia Trasporti S.p.a.** – this society manages the urban local public transport in Brescia; as the measure objective regards the realization of a new e-ticketing system for transports available in Brescia, it had an important role in the research and development activities and during the operational phase, through the distribution of the new cards.
- **Sintesi S.p.a. – Parking sector** - this society manages the urban parking in Brescia; as the measure objective regards the realization of a new integrated e-ticketing system for transports available in Brescia, it had an important role in the research and development activities and also the operational phase, through the distribution of the new cards.
- **Sintesi S.p.a. – Bike-sharing sector**- this is the part of Sintesi s.p.a. which manages the bike sharing service implemented in Brescia; in particular, this is one of the service integrated in the new contactless card. During the operational phase, it helped the distribution of the new cards, involving about 6000 users and new potential ones.
- **Brescia Municipality** – the partnership with Brescia Municipality has been considered fundamental, because it integrated the information spread, for example through activities and events promoted during the European Mobility Week.

### D.3.2 Stakeholders

- **Brescia citizens** - Inhabitants of the city of Brescia. were direct involved through administering them a four-monthly customer satisfaction survey, interviewing 1200 actual and potential users. Citizens have been also involved in a promotional event, on 4<sup>th</sup> of July 2011, when the new integrated card has been officially presented.
- **Bike sharing, LPT and parking users (existing and potential ones)** - these ones have been directly involved during the operational phase, as the new contactless card have been distributed (since July 2011).
- **New contactless card and validation system providers** - these ones have been involved during the implementation phase, from a technological point of view; as a matter of fact, they participated to the SW and hw update of the e-ticketing system in Brescia.
- **Phone partners and banks** - These ones have been relevant stakeholders, as they have been involved in NFC research phase of this new technology.

## D4 Recommendations

### D.4.1 Recommendations: measure replication

- **Find out potentially stakeholders involved** – a feasibility analysis is necessary in order to evaluate the willingness and the interests of who is potentially involved in the measure implementation.
- **Strict collaboration with new technology providers** - a strict collaboration with the new technology provider (as the new integrated card) is necessary, in order to solve quickly the technological issues and to make reliable and safe the renewed e-ticketing system.

### D.4.2 Recommendations: process

- **Collaboration among partners** – the collaboration among different partners has been fundamental from the start of the measure, as it has been possible among Brescia Mobilità, Brescia Trasporti, Brescia Municipality, Sintesi Bicimia and all involved providers.
- **Dissemination improvement** – the direct stakeholders involvement, not only through newspaper, but also with a dissemination campaign with meetings and presentation, which should be widespread throughout the country of Brescia. This campaign is fundamental, in order to increase the awareness of the available services and the use of LPT and intermodality in the city.

## Annex 1: Historical data series for the BaU calculation

- **Indicator 1** (Average cards validation per year) –

2008	Validations c-less cards on SIA busses	Validations c-less cards on BST busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
January	108416	699164	21490	37,58
February	107025	722146	21149	39,21
March	116075	685911	21529	37,25
April	118927	715614	21471	38,87
May	110020	680782	20980	37,69
June	77862	523115	20457	29,38
July	66075	465009	19172	27,70
August	40118	316289	17241	20,67
September	104161	641600	21618	34,50
October	131205	787393	22738	40,40
November	117004	696291	22255	36,54
December	92519	564744	22178	29,64
<b>TOTALS</b>	1189407	7498058	252278	34,44

Tab.A1.1: Ex ante situation indicator 1, year 2008

2009	Validations c-less cards on SIA busses	Validations c-less cards on BST busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
January	100285	602832	21515	32,68
February	106736	641097	21081	35,47
March	116801	702115	21529	38,04
April	102526	615830	21195	33,89
May	103998	618228	20346	35,50
June	80870	508006	19606	30,04
July	66571	421364	17987	27,13
August	30061	275964	17101	17,90
September	97398	555398	22070	29,58
October	121940	679375	22857	35,06
November	103540	638051	22099	33,56
December	81470	521074	21477	28,06
<b>TOTALS</b>	1112196	6779334	248863	31,71

Tab.A1.2: Ex ante situation indicator 1, year 2009

2010	Validations c-less cards on SIA busses	Validations c-less cards on BST busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
<b>January</b>	85432	544175	19088	32,98
<b>February</b>	90155	563549	20838	31,37
<b>March</b>	105379	668151	18865	41,00
<b>April</b>	87739	582592	18701	35,84
<b>May</b>	88897	582435	17896	37,51
<b>June</b>	70022	430122	15207	32,89
<b>July</b>	56558	387462	13211	33,61
<b>August</b>	38447	280453	11893	26,81
<b>September</b>	81421	542683	17181	36,33
<b>October</b>	99480	618833	19049	37,71
<b>November</b>	93452	590048	19341	35,34
<b>December</b>	77105	500398	16381	35,25
<b>TOTALS</b>	974087	6290901	207651	34,99

Tab.A1.3: Ex ante situation indicator 1, year 2010

2011	Validations c-less cards on BST + SIA busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
<b>January</b>	568953	18319	31,06
<b>February</b>	600143	19754	30,38
<b>March</b>	660908	18670	35,40
<b>April</b>	583143	18595	31,36
<b>May</b>	609938	18776	32,48
<b>June</b>	496708	16758	29,64
<b>July</b>	406670	13838	29,39

Tab.A1.4: Ex ante situation indicator 1, year 2011, up to July 2011

## Annex 2: Ex ante and Ex Post data collection

- Indicator 1** (*Average cards validation per month*) – The existing ticketing system consists of two kind of tickets: contact-less cards (for the season ticket holders) and the magnetic tickets (for occasional users). As the measure consists in distributing new contactless cards (MIFARE), this indicator is measured using data referred to the contactless cards validation. The indicator is collected monthly and it's calculated dividing the total number of c-less validations by the total number of valid season tickets. As specified in Stage n. 3, the New MIFARE cards arrived in May/June 2011, but the actual massive distribution of the cards has been carried out in September 2011. Therefore, the beginning of the on going data collection has been set in October 2011, once the new ticketing system can be considered actually thriving. As a consequence, the ex ante period has been lengthened up to July 2011. Here the average value for each year is given, calculated using the cards validation data sorted by month.

### EX ANTE SITUATION:

2011	Validations c-less cards on BST + SIA busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
July	406670	13838	29,39

Tab.A2.1: Ex ante situation indicator 1

### AFTER SITUATION:

2011	Validations c-less cards on BST + SIA busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
October	655215	23120	28,34

Tab.A2.2: After situation indicator 1

### AFTER SITUATION: (first data collection October 2011 and second data collection April 2012)

2011	Validations c-less cards on BST + SIA busses	Valid season tickets	Monthly average value (total validations/valid season tickets)
November	637854	24225	26,33
December	539792	23528	22,94
January	558897	22927	24,38
February	583540	23731	24,59
March	678364	24275	27,94

Tab.A2.3: After situation indicator 1

- Indicator 2** – (*Number of new cards distributed in a given time period*)

**EX ANTE SITUATION:** not scheduled.

**AFTER SITUATION:** (October 2011 - linked to the new ticketing system actual thriving).

This indicator is built considering the number of new MIFARE cards distributed for the LPT service in a given time period.

**First data collection (October 2011)**

690 new cards have been distributed for the LPT season tickets. The total number of new cards distributed is actually 6010, but this value includes also the new cards that have been distributed for other interoperable services, such as trenocittà, ioviaggio Lombardia and SIA bus network.

Indicator n.2 (October 2011) = 690

**Second data collection (April 2012)**

561 new cards have been distributed for the LPT season tickets from November 2011 to march 2012. The total number of new cards distributed is actually 7333 (1323 of which have been distributed from November 2011 to march 2012), but this value includes also the new cards that have been distributed for other interoperable services, such as trenocittà, ioviaggio Lombardia, SIA bus network and LPT in the city of Desenzano del Garda (BS).

Indicator n.2 (October 2011) = 561

- **Indicator 3** (*Number of new cards validated/ Total number of new cards*)

**EX ANTE SITUATION:** not scheduled.

**AFTER SITUATION:** The methodology is similar to the indicator 1 (built dividing the number of validations by the number of active season tickets), but data are referred to the new MIFARE cards distributed for the LPT service.

**First data collection (October 2011)**

(this value can correspond to the active season tickets loaded on the new cards).

Total number of validations (only LPT) = 5646

Total number of new cards distributed for the LPT service = 690

Indicator n.3 (October 2011) =  $5646/690 = 8,18$

**Second data collection (April 2012)** (this value can correspond to the active season tickets loaded on the new cards)

Total number of validations (only LPT) = 20172

Total number of new cards distributed for the LPT service (till march 2012)= 1251

indicator n.3 (April 2012) =  $20172/1251 = 16,12$

- **Indicator 4** (*Number/kind of fares/season tickets loaded on the new cards compared with the number of distributed new cards*)

**EX ANTE SITUATION:** not scheduled.

**AFTER SITUATION:** In order to investigate the intermodality attitude of the LPT subscriber, this indicator is built extracting from the e-ticketing database the number of users that activated, besides the LPT season tickets, also the bike sharing service, which can be loaded on the same card.

**First data collection (October 2011)**

In October 2011 the number of LPT subscribers who loaded also the bike sharing season tickets on the new MIFARE cards are 139 on a total of 690 new MIFARE cards distributed for the LPT service.

$$\text{Ind. 4} = 139/690 = 20,14\%$$

**Second data collection (April 2012)**

In April 2012 the number of LPT subscribers who loaded also the bike sharing season tickets on the new MIFARE cards are 236 on a total of 1251 new MIFARE cards distributed for the LPT service.

$$\text{Ind. 4} = 236/1251 = 18,86\%$$

- **Indicator 5** (*Number of card breaks/new cards distributed*)

**EX ANTE SITUATION:** not scheduled.

**AFTER SITUATION.** First data collection: October 2011. This indicator can be useful to evaluate the new cards performance/reliability, as for many reasons cards can break and must be replaced. Data recorded are not lost but must be reactivated on a new card. E-ticketing database is able to monitor the number of cards that have been replaced and this information is compared with the total number of new cards distributed.

**First data collection (October 2011)**

690 new cards distributed for the LPT

Number of cards breaks = 0

$$\text{ind. 5} = 0/690 = 0\%$$

**Second data collection (April 2012)**

1251 new cards distributed for the LPT

Number of cards breaks = 18

$$\text{ind. 5} = 18/1251 = 1,44\%$$

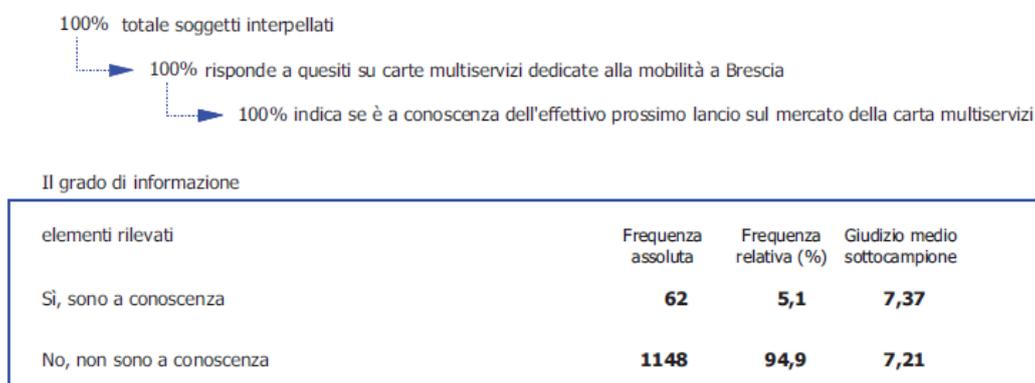
- **Indicator 6** (*Awareness level*) - This indicator (and indicator n. 7) is calculated through the BST Customer satisfaction inserting specific questions to the conventional survey. During the

conventional survey, interviews are 1200, repeated 3 times a year (April, July and November) and are carried out to Brescia Trasporti customers: 700 face to face and 500 by phone. The sample is drawn in two different ways: for face to face interview at the bus stops the place are identified on the basis of the lines, the end of the line or specific parts of lines; for the interview by phone there is a random sample from Omnibus Card database (subscribers) on the basis of ticket used.

**EX ANTE SITUATION** is referred to the period previous to the cards distribution, therefore, during the May 2011 survey, a specific question for the collection of this indicator has been inserted, namely:

- ✓ Do you know that a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon in Brescia?

Tavola 23 **Il grado di conoscenza dell'effettivo lancio sul mercato della carta multiservizi**



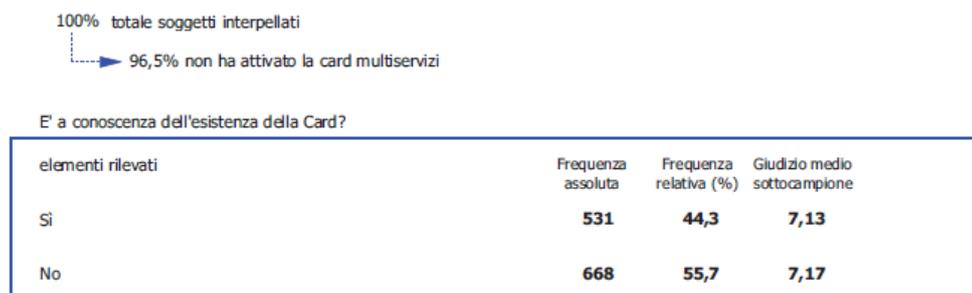
**Fig.A2.1: Specific question results for indicator 6**

Indicator 6 = 5,1 % of the interviewed people is aware of the imminent distribution of the new cards in Brescia.

**EX POST SITUATION** is referred to November 2011 survey, a specific question for the collection of this indicator has been inserted, namely:

- ✓ Do you know that a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is available in Brescia?

Tavola 29 **Grado di informazione sull'esistenza della Card, per i non possessori**



**Fig.A2.2: Specific question results for indicator 6**

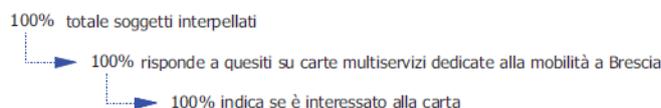
Indicator 6 = 44,3 % of the interviewed people is aware of the distribution of the new cards in Brescia.

- **Indicator 7 (Acceptance level)** - This indicator (like indicator n. 6) is calculated through the BST Customer satisfaction inserting specific questions to the conventional survey. During the conventional survey interviews are 1200, repeated 3 times a year (April, July and November) and are carried out to Brescia Trasporti customers: 700 face to face and 500 by phone. The sample is drowned in two different ways: for face to face interview at the bus stops the place are identified on the basis of the lines, the end of the line or specific parts of lines; for the interview by phone there is a random sample from Omnibus Card database (subscribers) on the basis of ticket used.

**EX ANTE SITUATION** is referred to the period previous to the cards distribution, therefore, during the May 2011 survey, a specific question for the collection of this indicator has been inserted, namely:

- ✓ Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?
- ✓ Would you be favourably disposed towards the payment of a symbolic 5€ key money?

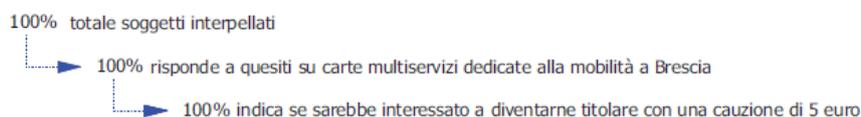
Tavola 22 **Interesse verso la creazione di una carta multiservizi dedicata alla mobilità in Brescia**



Il livello di interesse

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)	Giudizio medio sottocampione
Sì, sono interessato	315	26,0	7,36
No, non sono interessato	895	74,0	7,17

Tavola 24 **La propensione a diventare titolare della carta multiservizi**



La propensione all'acquisto

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)	Giudizio medio sottocampione
Sì, mi interesserebbe	268	22,1	7,38
No, non mi interesserebbe	942	77,9	7,17

**Fig.A2.3: Specific question results for indicator 7**

Indicator 7 = 26 % is interested in the new card

22,1 % is disposed to pay 5€ key money for the new card

**EX POST SITUATION** is referred to the period November 2011 survey, a specific question for the collection of this indicator has been inserted, namely:

- ✓ Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?
- ✓ Would you be favourably disposed towards the payment of a symbolic 5€ key money?

Tavola 30 **Grado di interesse per la Card, per i non possessori**

100% totale soggetti interpellati  
 → 96,5% non ha attivato la card multiservizi

Sarebbe interessata alla Card?

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)	Giudizio medio sottocampione	Tavole di approfondimento
Si	271	22,6	7,15	-----▶ Tav. 31
No	928	77,4	7,15	

Tavola 31 **Conferma dell'interesse di fronte all'ipotesi di una cauzione di 5 euro per l'attivazione**

100% totale soggetti interpellati  
 → 96,5% non ha attivato la card multiservizi  
 → 22,6% E' interessato alla Card

Conferma dell'interesse dopo l'indicazione dell'ammontare della cauzione

elementi rilevati	Frequenza assoluta	Frequenza relativa (%)	Giudizio medio sottocampione
Si	241	88,9	7,16
No	30	11,1	7,08

**Fig.A2.4: Specific question results for indicator 7**

Indicator 7 = 22,6 % is interested in the new card

88,9 % is disposed to pay 5€ key money for the new card

Customer satisfaction questionnaire where specific questions for the calculation of the indicators 6 and 7 have been inserted (may 2011 survey):

**Brescia Trasporti S.p.A.**  
**Rilevazione della soddisfazione della clientela - Indagine 2011**

Le informazioni che fornirà sono assolutamente anonime e tutelate dalla normativa sulla privacy (legge 675 del 1996 e successivi aggiornamenti).

**Dati personali**

<b>Sesso</b>	Studente Medie o Superiori Studente universitario	<b>Luoghi di partenza e di arrivo dei viaggi con i mezzi di Brescia Trasporti</b>	Luoghi in Brescia città Centro storico Stazione Altro luogo in Brescia	Borgosatollo Botticino Bovezzo Caino Castelmella Cellatica Collebeato	Concesio Flero Gussago Nave Poncarale Rezzato Roncadelle
<b>Età</b>	Lavoratore dipendente Lavoratore autonomo Pensionato				
<b>Occupazione</b>	Casalunga Senza occupazione				

**Modalità di utilizzo dei servizi di Brescia Trasporti S.p.A.**

<b>Freq. di utilizzo (n° corse/settimana)</b>		Carnet 10 corse Abb. Settimanale	Supporto utilizzato per il titolo di viaggio	Cartaceo Omnibus Card
<b>Motivi di utilizzo del mezzo pubblico</b> (indicare con "P" il motivo principale, con "S" quelli secondari)	Studio Lavoro Shopping Commissioni Relazioni personali Motivi di salute Casi eccezionali	<b>Titolo di viaggio utilizzato</b> Zona 1 Zona 2 Zone 1+2	Corsa semplice Biglietto 24 ore Abb. Mensile Abb. Mensile integrato Abb. Annuale Abb. Annuale integrato Tessera libera circ. Carnet 12 corse	<b>Linee utilizzate</b> <b>Tratte consecutive</b> <b>Altri mezzi integrati nello stesso viaggio</b>
<b>Tempo mediamente impiegato per lo spostamento: ..... minuti</b>			<b>Da quanto tempo è titolare di Omnibus Card?.....</b>	
<b>Quali dei seguenti strumenti di comunicazione utilizza?</b>	Mapa della rete Libretto orari Call center Dialogo con l'autista Informazioni alle fermate Internet		<b>Ha a disposizione un mezzo alternativo all'autobus? Quale?</b>	
		In caso vengano indicate le informazioni alle fermate, specificare se:	informazioni fornite dalle paline elettroniche	informazioni riportate nelle tabelle orari

**E' interessata ad una card multiservizi che consenta di utilizzare, oltre al trasporto pubblico, servizi come Bicimia, parcheggi in struttura e futura metropolitana?**  Sì  No

**E' a conoscenza che fra breve verrà messo sul mercato un nuovo tipo di card multiservizi con cui potersi abbonare a TPL, Bicimia, parcheggi in struttura e futura metropolitana?**  Sì  No

**Se la card comportasse una cauzione di 5 euro, Le interesserebbe?**  Sì  No

Fig.A2.5: Customer satisfaction questionnaire

## Annex 3: Focus Group Activities

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>	<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità		
<b>STEP 1</b>	<b>Accoglienza e riscaldamento (circa 10 minuti)</b>		
	1) Presentazione degli invitati al gruppo di discussione.		
	2) Presentazione dei ricercatori.		
<b>STEP 2</b>	<b>Introduzione al tema della discussione (circa 10 minuti)</b>		
	3) Motivazione e condizioni (fasi e tempi) dell'incontro di gruppo in data _____		
	- Metro Package (MP); - lighthouse measures; - indicatori.		
	4) Gli obiettivi dell'incontro sono:		
	- condivisione metodologia per lo svolgimento del Focus Group; - attuazione del Focus Group.		
<b>STEP 3</b>	<b>Fasi della ricerca: descrittiva, riflessiva e propositiva</b>		
	<b>TEMA</b>	<b>MISURA</b>	<b>METROPACKAGE</b>
	Azzeramento della conoscenza e condivisione degli input (ipotesi scenari)		
	Potere decisionale in relazione al tipo di scelta da attuare		
	Percezione di rischi/problematiche oltre Civitas (ad esempio, entrata in esercizio della metro)		
	Ruolo di ciascun intervento per il funzionamento del MP: - bike sharing; - parcheggi; - BMC; - intermodalità; - e-ticketing; - politiche di tariffazione; - gestione della mobilità.		
<b>STEP 4</b>	<b>Verifica di fattibilità e scelta finale</b>		
<b>STEP 5</b>	<b>Assegnazione dei ruoli</b>		
<b>STEP 6</b>	<b>Sintesi dei risultati:</b>		
	- per singola misura; - per Metro Package		

Fig. A3.1 General structure of the Focus Group activities

		Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>		<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>		M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>		- Brescia Municipality - Sutera - Verità		
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>		
Date: <b>15 november 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari		
	BSM	Sbardella, Gussago, Ragnoli, Pace		
	BST	Sutera		
	CBS	Bresciani		
	BICIMIA	Verità		
<b>Main topics</b>	1) Scambio ERT tra i vari Partner per condividere le attività previste nelle diverse misure; 2) Rivedere i contenuti insieme, in modo da avere COERENZA nella descrizione delle misure; 3) Prevedere un rimando corretto e concordato in tutte le misure collegate (es. 02.02 e 02.03); 4) Coinvolgimento Bicimia (geom. Verità) per testare l'efficacia della distribuzione delle tessere OMNIBUS e il loro funzionamento per gestione P&R (verificare tracciabilità dei dati) e scegliere un Parcheggio + BICIMIA (x es. in centro), dove si hanno dati e uso della OMNIBUS 5) considerare solo timbrature e uso delle OMNIBUS (no altre carte!!!) 6) necessità di ricevere (dal CBS???) una tavola con la localizzazione dei Parcheggi per la Metropolitana e il numero degli stalli (deve essere base condivisa!!!) 7) usare modello di BSM come previsto nella M02.02 8) concentrarsi anche solo su uno scenario, Parcheggio e analizzarlo benissimo!! 9) portare dati e info al prossimo incontro (15 dicembre) 10) rendicontare questa attività nel Process Evaluation Form (Focus, coordinamento e condivisione) 11) vedere indicatori delle misure, in particolare quelli legati alla simulazione metropolitana e collaborare per la raccolta (usare modello della M02.02)			
	Prossimo incontro fissato per il 19 Dicembre 2011 a Brescia Mobilità			

**Fig. A3.1 Focus Group activities – Convocation of the 1th meeting (15 November 2011)**

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>	<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>	- Brescia Municipality - Sutura - Verità		
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>	
<b>Date: 19 dicembre 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari	
	BSM	Sbardella, Gussago, Ragnoli, Pace	
	CBS	Bresciani	
<b>Main topics</b>	1) Verifica dello scambio dei dati di input per la coerenza degli scenari per i parcheggi; 2) inquadramento delle misure M02.03 e M08.05 (in qualità di possibili lighthouse measures) all'interno del Metro Package; 3) cronogramma della M02.03; 4) soluzioni trovate per la registrazione dell'utilizzo del servizio P&R per gli utenti occasionali (sistemi, fornitura, test); 5) determinazione e consapevolezza della capacità decisionale che il ML ha come responsabile della misura; 6) analisi della percezione di rischi/problematiche oltre Civitas; 7) definizione del ruolo del Mobility Manager all'interno del Focus Group 8) proposta dell'organizzazione di un Focus Group aperto al pubblico (individuando persone da coinvolgere) per avere opinioni e aspettative da parte dell'utenza in merito a bike sharing, parcheggi, BMC, ecc., da considerarsi come azione di dissemination		
	Prossimo incontro possibile: prima della riunione tecnica di febbraio		

Fig. A3.1 Focus Group activities – Convocation of the 2nd meeting (19 December 2011)

## **M03.03 – Executive summary**

The city of Brescia was traditionally characterized by mono-modal mean of transport. The realization of a metro line, in addition to tradition LPT (namely, bus lines), and, at the same time, the Civitas project implementation were considered good occasion to implement a measure, which aimed to predispose the Park and Ride (P&R) system in Brescia, to be implemented after the light metro activation in 2013. This service was considered particularly important to reduce the private traffic entering the city from the suburbs.

Considering the advancement state of the metro works in Brescia, the interchange Parking weren't, as they're part of the complementary civil works still to be completed by 2013, the activities implemented in this measure have to be considered necessary and preliminary to the actual P&R system implementation. The P&R solution for Brescia, from the technological point of view, was based on the identification of two kinds of P&R users: the systematic ones and the occasional ones. The technological solution to manage the special P&R fares have been developed separately: for the systematic users it's possible to use the new contactless and integrated Omnibus Card (realized thanks to the Civitas Measure 02.03 ("Development and upgrade of e-ticketing system in Brescia"), able to manage at the same time 4 different kind of season tickets (LPT, metro, bike sharing and parking). For the occasional users, a special double-face ticket was developed, able to register on a unique support both the LPT and the Parking validations, in order to apply the special P&R fares.

The activities were concluded after the successful experimental phase concerning the communication between the ticket, the software and the ticket machine and in the application of the special P&R fare.

In this framework the main results have been:

- The successful development of a software able to manage the P&R system (The test phase has been carried out in September 2011);
- The positive upgrade of the existing HW platform for Park & Ride in terms of technology development (Omnibus cards, double face tickets);
- The distribution of more than 7000 4k Mifare cards towards parking, bike sharing and LPT users.

Creation of interoperability between public transport services and parking services

In addition to the new designed and realized Omnibus Card, it has also been possible to update the ticketing system for the parking users and to test a new integrated technology (software and hardware), with new double face tickets for occasional parking users.

## A. Introduction

### A1 Objectives

The measure objectives are:

(M) High level / longer term:

- To accomplish the dispositions of the Regional Plan for the development of an “Intelligent Mobility”<sup>10</sup> the main objectives of which are the development and the promotion of Intelligent Transport Systems (ITS) technologies for the enhancement of the infomobility services to citizens.

(N) Strategic level:

- To strengthen intermodality among different PT modes and vectors through integrated ticketing systems over wide areas including different transport services.

(O) Measure level:

- (1) To develop a new software (SW) functionality for the Automatic Fare Collection (AFC) management system for Park & Ride services;
- (2) To develop a new hardware (HW) platform for Park & Ride gates and ticketing machines;
- (3) To create interoperability between public transport services and parking services and to purchase/distribute at least 1.000 new cards (Mifare 1K or Mifare 4K) supporting also the new P&R service;
- (4) To define new typologies of fares for Park & Ride services;

To integrate the existing local public transport services with P&R, taking into consideration the start up of the new metro line in Brescia foreseen by 2013.

### A2 Description

The city of Brescia is building a metro line (Metrobus). Its start up is foreseen by 2013. Intermodal integration between private and public transport modes are the main goal for the City. Park and Ride services are particularly important in order to reduce the private traffic entering the city from the suburbs. To prompt Park and Ride new technologies have been developed:

- the Omnibus card, for seasonal users (developed in detail in measure 02.03 “Development and upgrade of the e-ticketing system in Brescia”);
- An integrated system SW/HW that allows Park and Ride using only one ticket for occasional users.

This technology development is the main focus of the present measure.

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<sup>10</sup> D.g.r. 27/12/2007-8/6411

Another important aspect of this measure is related to fare integration between LPT (Metrobus, buses) and parking that was investigated in order to reach the integration by the start up of the metro.

## B. Measure implementation

### B1 Innovative aspects

- New conceptual approach
- Use of new technology/ITS

The innovative aspects of the measure are:

- **Innovative aspect 1 (New conceptual approach)** – Nowadays in Brescia there is not a common ticketing system able to manage at the same time Parking and Public Transport tickets. The new designed system should grant intermodality among different services. This new intermodality approach should promote the use of alternative transport modes.
- **Innovative aspect 2 (Use of new technology/ITS)** – The innovative aspect consists of the technological integration of the public transport and parking system introducing new cards compatible with ISO 14443A & B standards (the international standard that defines proximity cards used for identification and the transmission protocols): one is the ticketing system based on a microchip contactless card able to manage different services (such as LPT, Parking, Bike Sharing and the new metro line). This system was developed in Civitas measure M02.03 (“Development and upgrade of the e-ticketing system in Brescia”); the other is the development of a bi-modal (magnetic/optical) ticket and its related SW and HW.

### B2 Research and Technology Development

The integration of the P&R service in the new multiservice cards was part of a wider project (developed in Brescia through the implementation of the measure 02.03 “Development and upgrade of the e-ticketing system in Brescia”) for the integration also of the bike sharing and the future metro ticket services.

The main research activity for this measure consisted in finding out the best way to integrate the parking tickets and the Local Public Transport (LPT) tickets managed by different Brescia Mobilità companies. The goal was to provide a single ticket to those users that would reach “interchange parking” and would take the future metro line.

The results of the undertaken research activities led Brescia Mobilità to integrate the technological solutions already adopted in the existing system adapting the parking ticket machines to treat also PT new tickets. This solution seemed to be the best one, both for the occasional and the seasonal users, especially from an economical point of view.

This result was useful also for the new “Omnibus” cards – “seasonal users” (Civitas measure M02.03 “Development and upgrade of the e-ticketing system in Brescia”) that are used in LPT and were integrated with the parking access control system, from a software compatibility and tickets readability point of view.

The deadline for parking facilities construction (P&R facilities) is foreseen at the metro line start up by 2013.

### B3 Situation before CIVITAS

For Public transport service since 2003 there has been an electronic ticketing system based on the use of magnetic and contactless cards (standard ISO 14443 B type). For the parking system there are RFID (Radio Frequency IDentification) magnetic cards and bar code tickets.

There wasn't an easy solution for the integration of these technologies.

Civitas project can be considered fundamental, as it allowed the development of the necessary research, demo and testing activities in terms of technology development.

### B4 Actual implementation of the measure

The measure was implemented in the following stages:

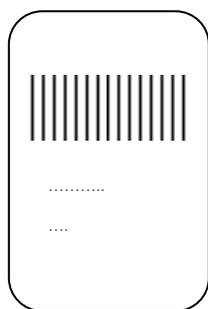
**Stage 1: research activities and software development for the communication with card ISO 14443A type** (from October 2009 to October 2011) – The main objective was to provide the executive design of the park and ride system that Brescia Mobilità SpA intended to carry out for the management of the intermodality, proposing solutions that allowed users to easily access to the future metro line through interchange parking areas.

Starting from classifying users into different kinds (“occasional users” (short-lasting parking) and “regular users” (longer parking) and that usually purchase season parking tickets), the following solutions were studied: tickets for Park & Ride system based on the use of magnetic tickets for the occasional customers and Mifare cards for the subscribers.

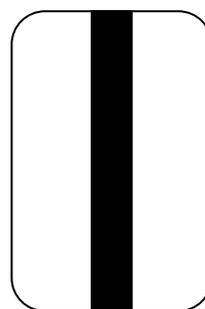
In particular, at the beginning, for the so called “occasional users” the technical feasibility for the implementation of a ticket management system based on a chip installed on paper support was investigated. The cost of these tickets was too high (about 0.40 € / each). It was decided to look for a cheaper solution that could integrate the readability of the Local Public Transport tickets and the parking tickets. The solution was to use tickets compatible with the existing magnetic ticketing system.

The readability problem was caused by the presence of two different kinds of ticket reader machines (one for parking and the other for LPT) and besides by the monopoly of the company which provides the parking devices. This company didn't want to substitute its devices: a new card that could be read by both the devices had to be developed.

The new ticket is double face (fig. 1). It has a thermal paper on one side for the parking service and a magnetic stripe on the other for the public transport. This solution allowed the P&R using only one ticket, with acceptable costs for the citizens.



Side A thermal paper (parking)



side B magnetic stripe (public)

Fig. 1 – New double face ticket

Another problem related to the use of a single ticket was the computation of different fares applied for parking and LPT (Rides). Therefore special attention had to be paid to the system configuration for the management of different fares and for the computation of the effective amount due to the customer (a single card deals services managed by different companies). The problem for the systematic users (season tickets subscribers) had already been solved in Civitas measure M02.03 (“Development and upgrade of the e-ticketing system in Brescia”). The Omnibus card developed can manage up to 4 different services at the same time, namely Bike Sharing, existing Local Public Transport, Parking and the future metro service. In this measure the evaluation of users’ attitude towards intermodality was explored in order to better manage the assessment of the Omnibus cards in relation to Park and Ride action.

**Stage 2: compatibility test and equipment of the park & ride site** (from October 2011 to October 2012) – This stage consisted in several compatibility tests that were necessarily carried out in order to set up P&R service.

Tests were carried out on the existing electronic ticketing machines and sale devices, already upgraded with a new management system. The installation of the necessary devices was made during a test phase (as it was not possible to make a real system implementation on the metrobus because it was not active yet).

On 18<sup>th</sup> of May 2012 also a demonstration was organized in order to present the new ticketing system for P&R users and test the new HW-SW system at the stakeholders’ presence (Brescia Mobilità and other companies involved in this project).

During the demo activity, a more compact HW device was presented. This is the one used for the P&R parking columns (fig. 2).

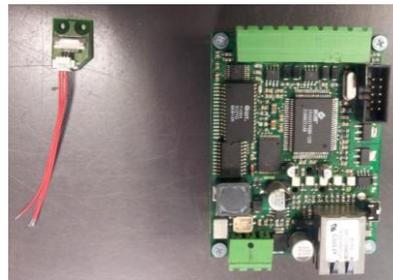


Fig. 2 - The HW part of the system for P&R service

In synthesis, Brescia Mobilità has integrated the parking thermal ticket with the magnetic public transport ticket, through a double face one (with a thermal paper on one side for the parking service and a not standard magnetic stripe on the other for the public transport – fig.3).



Fig. 3 - An example of punched double face ticket punched both for park service and LPT service

During the system design and realization, for what concerns the HW-SW functioning several scenarios were considered. The new ticket works as following (test phase done in September 2012, using an existing parking, technological device.

- When the “occasional user” enters the parking and pushes the button, the “Skidata” small column produces a double face ticket.
- If the user punches the ticket on LPT, this activity is recorded by the magnetic stripe.
- when leaving, the ticket is put into the “Skidata” small column slot in the right way and the magnetic stripe is read on both sides as the barcode allows to detect the signal directly from the second magnetic head of Coder Unlimited Skidata;
- If the ticket was punched on LPT, a discount is applied; otherwise the user pays the full price.

The actual use of these tickets will begin with the start up of the Metrobus by 2013, the new ticket machines to be installed in interchange parking have already been ordered.

As result of the test phase it should be underlined that no breakings, system errors or anomalies occurred and no errors of the special fares assigned were pointed out.

## B5 Inter-relationships with other measures

The measure from a theoretical point of view is grouped with all the other measures proposed in Brescia, using Civitas plus funding, to study the new public transport asset after metro realization (Metro package):

- M.02.02 “Intermodality with public transport”;
- M.02.03 “Development and upgrade of the e-ticketing system in Brescia”;
- M.08.05 “Brescia Mobility Channel”.

In particular from a research and technological development point of view it is linked to

- M.02.03 “Development and upgrade of the e-ticketing system in Brescia”;

If the new contactless cards hadn’t been developed, subscribers wouldn’t have had the possibility to use a unique ticket for the P&R solution. Besides the measures have common indicators related to seasonal users (i.e. Omnibus card) and are based on similar assumptions for what concerns the BAU building.

## C. Evaluation – methodology and results

From the evaluation point of view this measure consists mainly of research and demonstration activities, as its outputs will be tangible only after the realization of suburban parking structures and, above all, after the start up of the Metrobus (2013).

Anyway, some considerations can be made starting from interchanges between Park/LPT and Bike Sharing (even if bikes haring isn't funded by Civitas).

In fact, citizens attitude to intermodal split can be measured trough the Omnibus card monitoring users of Bike Sharing/Parking and/or of Bike Sharing/buses and/or of Parking/buses. Besides this activity is also useful to check the new cards functioning.

The measure outputs regard the solution of technological problems:

- on the one hand the new e-ticketing testing (Measure 02.03 “Development and upgrade of the e-ticketing system in Brescia”) through the distribution to the public of Mifare cards able to manage 4 mobility services at the same time (including P&R);
- On the other the new HW platform development for the P&R gates/ ticketing machines able to manage P&R service for the occasional users (who use magnetic tickets).

### C1 Measurement methodology

In order to evaluate the capability and the effectiveness of P&R measure, besides the quantitative indicators reported below, a round table was arranged among the people in charge of the services chargeable on the new cards (regardless of their participation in Civitas).

The goal of the round table was to measure:

- The new card outputs crosswise
- The kind of season ticket loaded on the cards
- The use subscribers made of it and
- The number of potential Park & Ride users.

These data were useful to get additional quantitative information adding to the simulation activities, as, for example, indicator 3.1 “Number of potential P&R users per day (simulation)” (calculated through model-based simulations referring to the future metro line).

The measure was considered like a qualitative measure because it developed a technological solution and device to allow P&R with a single ticket. Therefore the indicators below should be considered as complementary indicators.

#### C1.1 Impacts and Indicators

As the measure mainly consisted in research/demo and technological development activities, the indicators must be considered as additional information to the technological implementation of the measure.

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Transport	Percentage of cards validation per year	Validations of the contactless cards recorded by the system	Complementary indicator First data collection after the o.p. in November 2011
2	Transport	Percentage of new cards validation per month	Validations of the new cards recorded by the system	No more collected, because the system is not able distinguish old and new cards, replaced by 2.1
2.1	Transport	Number of new cards activated with at least 2	recorded by the system	Ex ante not foreseen First data collection after the o.p. in

		season tickets		March 2012
<b>3</b>	Transport	Number of interchanges per km of trip		No more collected, substituted by 3.1
<b>3.1</b>	Transport	Number of potential P&R users per day (simulation)	Simulation model M02.02 (Intermodality with public transport)	Main Indicator Ex ante not foreseen (Simulation)
<b>4</b>	Society	Awareness level	Survey	Ex ante: survey May 2011 (before cards distribution) + information coming from Customer satisfaction scheduled for M02.03 After data collection: survey April 2012 + information coming from Customer satisfaction scheduled for M02.03. Complementary Indicator
<b>5</b>	Society	Acceptance level	Survey	Ex ante: survey May 2011 (before cards distribution) + information coming from Customer satisfaction scheduled for M02.03 After data collection: survey April 2012 + information coming from Customer satisfaction scheduled for M02.03. Complementary Indicator

## Detailed description of the indicator methodologies:

- **Indicator 1** (*Percentage of cards validation per year*) – The existing parking system users can be divided into two categories: season tickets holders (who use a contactless card) and occasional users (who use a bar code ticket). The calculation of this indicator can be made dividing the total number of season tickets validations in regulated car parking by the total number of valid season tickets. The ex ante situation is referred to the period previous to the new contactless card distribution (Mifare cards) scheduled in September 2011, according to the progress in the implementation of the measure 02.03 (“Development and upgrade of the e-ticketing system in Brescia”). Data are provided by the company “SINTESI S.p.A.” that manages the parking system in Brescia.
- **Indicator 2** (*Percentage of new cards validation per month*) – This indicator can be measured using validations data (as scheduled for the indicator 1) referred only to the new mifare contactless cards. Data are provided by the company “SINTESI S.p.A.” that manages the parking system in Brescia. **NO MORE COLLECTED.**
- **Indicator 2.1** (*Number of new cards activated with at least 2 season tickets*) - This indicator has been added to measure the attitude to interchange in LPT in Brescia, even if the metro start up is foreseen in 2013 and the interchange parking are not available at the moment.
- **Indicator 3** (*Number of interchanges per km of trip*) - The existing LPT network has been taken as reference for the ex ante situation and the simulated new network scenarios don't depend neither on the parking nor on the interchange parking localization. **NO MORE COLLECTED.**
- **Indicator 3.1** (*Number of potential P&R users per day - simulation*) - P&R structures won't be ready before the Metro start up, therefore this indicator is calculated basing on a simulation model (CUBE). The scenario takes into account the future metro line and the location of the interchange parking (that have already been designed). Simulation activities take into consideration also the parking capacity, which is strictly related to the selected area. Indicator

values have been taken from the simulation activity carried out during the Civitas measure implementation M02.02 ("Intermodality with public transport in Brescia"). The scenarios aimed to reorganize the potential P&R users in the view of the metro start up (2013).

- **Indicator 4 (Awareness level)** - According to the progress in the implementation of the measure 02.03 (e-ticketing), a consistent number of new cards has been distributed in September 2011. (By the end of April 2011 a Focus Group has been arranged to better understand the interest towards P&R solutions in Brescia and towards its awareness in relation to the potential offered by the integration of transport fare system. In particular, the situation concerning the increasing number of multi-service cards and their potentials in mobility applications has been presented. The meeting has been an occasion to prepare the questionnaire to be administered to P&R potential users in order to collect this indicator after the new cards distribution). An interesting source of information about the aptitude towards the multi service cards introduction and the integration of different transport solutions can derive from the specific question inserted in the May 2011 customer satisfaction in occasion of the collection of some M02.03 ("Development and upgrade of the e-ticketing system in Brescia") indicators. The specific question is the following:  
"Would you be interested in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro?"  
Another questionnaire has been carried out among the parking users in March 2012, in addition to the customer satisfaction questionnaire administered in April 2012.

The question of the focus group survey was:

*"Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be soon introduced?"*

The specific question of the customer satisfaction survey was:

*"Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon in Brescia?"*

These questions have been updated during the Civitas project, considering the implementation of the measure and the distribution of the new integrated card.

- **Indicator 5 (Acceptance level)** – The methodology is the same reported for the indicator n.4.

The question of the focus group survey was:

*"With such a card, would you be more disposed to make the best use of P&R service (intermodal Parking – Local Public Transport)?"*

*"Would you be disposed to pay a symbolic key money (5€) for this new card?"*

The specific question of the customer satisfaction survey was:

*"Would you be disposed to pay a symbolic key money (5€) for this new card?"*

These questions have been updated during the Civitas project, considering the implementation of the measure and the distribution of the new integrated card

## **C1.2 Establishing a Baseline**

Since the beginning of the twentieth century the city of Brescia has characterized by an integrated management of the local public transport. Progressively, also the parking service and other complementary activities, such as the traffic lights management and the violation enforcements (multaphot and multanova) have been added to the integrated management.

Brescia Mobilità Spa (metropolitan mobility company) was born in December 2001, after the divestiture from the original Company ASM Brescia Spa. Brescia Mobilità Company structure includes the following services and sectors:

- Public Transport (Brescia Trasporti Spa)
- Parking and parking meters (Sintesi)
- Traffic lights and innovative technologies
- Driverless light metro (Metrobus)

It's important to highlight that at the moment the promotion of the interoperability between the public transport and the parking system before the start up of the metro (foreseen in 2013) can be considered as a strategic measure objective.

The new metro line will make the public transport more efficient, but it the modal shift from car to Metrobus will be conditioned by the efficiency of intermodal areas and mainly by the Park and Ride organization (their location, equipment, and the development of flexible and easy to handle tickets).

Before the start up of the metro line, the new technology introduced by the CIVITAS measure 02.03 ("Development and upgrade of the e-ticketing system in Brescia"<sup>11</sup>), represented a valid tool able to significantly test the new card potential towards the future intermodal mobility attitude of the city. This is why the indicator 1. Percentage of cards validation per year was chosen as reference for the monitoring of the measure impacts, as its trend could be influenced by the introduction of the new contactless card, scheduled in October 2011.

Therefore the baseline of the measure was set in spring/summer 2011, before the new card distribution foreseen in autumn 2011

<b>Indicators M. 03.03</b>	<b>BASELINE (spring/summer 2011)</b>
1. Percentage of cards validation per year	April 2011 20,3 (Total number of season tickets validations in regulated car parking / Total number of valid season tickets)
Tab.1 - Baseline value of indicator 1	

The indicator 2.1 (Number of new cards activated with at least 2 season tickets) has 0 (no service) as baseline value because it's referred to the new cards.

Indicator 3.1 (Number of potential P&R users per day - simulation) isn't considered in the baseline, because before Civitas the city hadn't developed P&R services yet (i.e. parking areas for the Metrobus + integrated fares) and its citizens still have mainly a "mono-modal" attitude in relation to P&R action.

Indicator 4. (Awareness) and 5. (Acceptance) are the results of a "test survey" administered on P&R in June 2011 specifically to the focus group members (this survey is not statistically relevant) and it proves the interest for P&R service (91% of the interviewed would use P&R service).

<b>Indicators M. 03.03</b>	<b>Focus group (spring/summer 2011)</b>
4. Awareness level	June 2011 59% of the interviewed is aware of the new card distribution in Brescia
5. Acceptance level	<ul style="list-style-type: none"> <li>• June 2011</li> <li>• 91% of the interviewed would use P&amp;R service</li> <li>81% of them is disposed to pay 5€ key money for the card</li> </ul>
Tab.2 - Focus group (spring/summer 2011): value of indicators 4 and 5	

<sup>11</sup> which consists of a contactless card able to manage at the same time four different kind of season tickets, such as public transport, parking, bike sharing and the future metro line)

To build a quantitative baseline on awareness and on acceptance the same baselines used for measure 02.03 “Development and upgrade of e-ticketing system in Brescia” were used, because they investigate the citizens’ interest (attitude) for intermodality and it was performed through a customer questionnaire.

Indicators from M. 02.03 used for M03.03	Baseline
4. Awareness level From M.02.03 ind. 6. Awareness level	<ul style="list-style-type: none"> <li>5,1% (informed on a multi-service card - able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro).</li> </ul>
5. Acceptance level From M. 02.03 ind. 7. Acceptance level	<ul style="list-style-type: none"> <li>26% (interest in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro); 22% (payment of a symbolic 5€ key money)</li> </ul>

Tab.3 - Baseline value of indicators 4 and 5

### C1.3 Building the Business-as-Usual scenario

Brescia Mobilità (subsidiary of the Municipality of Brescia) was born to carry out and manage initiatives aiming at improving mobility in the urban area. The most important objective of the Brescia Mobilità Group’s mission is planning and managing the city, according to the Municipality’s strategies and policies, developing different activities regarding mobility.

In time, the Group acquired the management of several parking and set up new parking structures (table 4). Urban parking policies developed by Brescia Mobilità Group introduced new technologies for the parking season tickets management, such as RFID.

PARKING	N. OF PARKING SPACES	BUILDING/TAKING OVER YEAR
Autosilo 1	350	Taking over since 2010
Benedetto Croce	72	2003
Brescia 2 (ex Inail)	153	Taking over since 2006
Crystal	500	Taking over since 2004
Domus (reserved for the hospital employees)	200	2008
Fossa Bagni	385	2002
Freccia Rossa	2500	2008
Massimo D’Azeglio	35	2004
Ospedale nord	1260	2002
Ospedale sud	500	already managed by ASM Brescia SpA before 2001
Palagiustizia	570	already managed by ASM Brescia SpA before 2001
Piazza Mercato	190	already managed by ASM Brescia SpA before 2001
Piazza Vittoria	450	Taking over since 2006 (built in the seventies).

PARKING	N. OF PARKING SPACES	BUILDING/TAKING OVER YEAR
Randaccio	170	2001
San Domenico	72	2005
Stazione	1000	already managed by ASM Brescia SpA before 2001

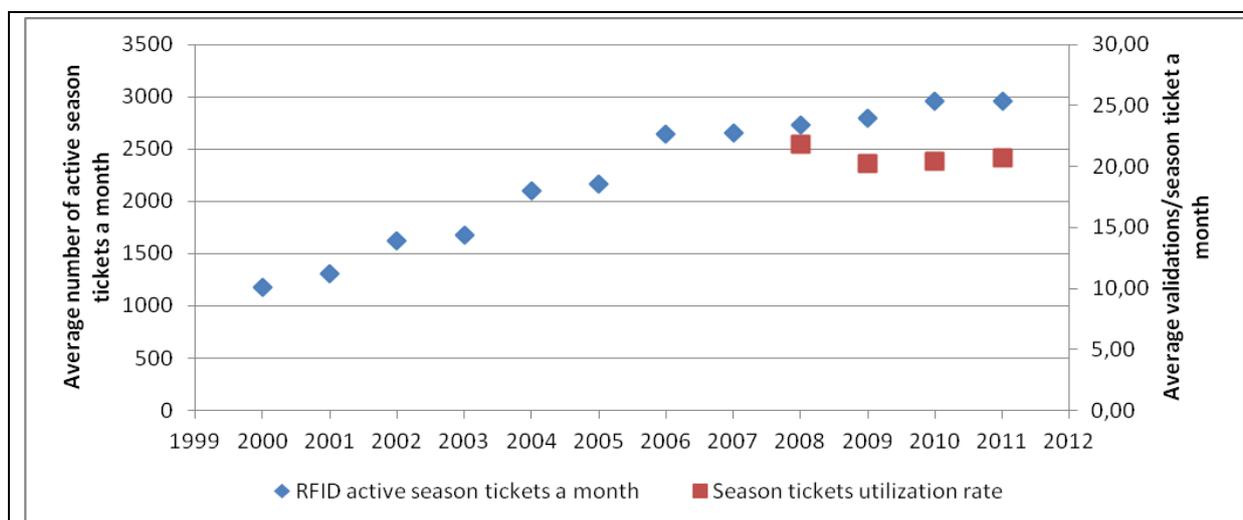
Tab.4 - Parking structures managed by Brescia Mobilità Group

The integrated mobility management done by Brescia Mobilità Group led to the introduction of parking fare policies addressed to the promotion of the public transport. For example a free bus ticket is offered whenever the parking fare is higher than the regular bus ticket cost.

the effective use of the free bus ticket cannot be assessed because because the paper ticket doesn't need to be stamped on the bus: it valid only for the parking day, so the users cannot be monitored in any way.

In order to build the BAU it must be underlined that the number of fee parking season tickets has been growing in time.

In fact the monthly average number of active fee parking season tickets (fig. 4), in relation to the number of parking spaces, is characterized by a positive trend and the RFID season tickets utilization rate (expressed by the average number of validations per ticket a month) strengthens the role of the fee parking season ticket in the city of Brescia.



**Graph 1**

**NOTES:**

- a) The Company which manages the fee parking system has collected data about the number of season tickets only since 2007. The reconstruction of the previous data has been made estimating the number of active season tickets in proportion to the total parking spaces offering.
- b) The RFID season tickets utilization rate has been calculated as the ratio between the number of season tickets validations and the number of active season tickets. It expresses the average number of validations per ticket a month.

Fig. 4 - Trend of monthly average number of active fee parking season tickets

In order to investigate the opinions and strategies toward CIVITAS measures, several interviews have also been arranged involving politicians and technicians.

As regards this measure, the Brescia Deputy Mayor (who is also Mobility and Traffic Town Councillor) and the Brescia Mobilità Spa General Director have been interviewed. Both of them consider CIVITAS an essential driver for the pushing forward of the activities linked to the Metro line launch.

In particular, the Brescia Mobilità Spa General Director, interviewed in July 2011, highlighted the crucial importance of the CIVITAS contribution in the realization of the new contactless cards and bi-modal tickets (i.e. P&R tickets). As a matter of fact, this activity wouldn't have been implemented (due of lack of resources) before the start up of the Metrobus.

The Business as Usual scenario equals the alternative zero, i.e. the "do nothing" alternative. In order to correctly evaluate the scenario 0, the following considerations have been made.

Basing on the preliminary remarks illustrated before, this measure can be considered a preparatory phase for the organization of the integrated management of city services (as far as the ticketing system is concerned) before the start up of the metro line scheduled by 2013.

The available historical data series, considered significant respect to the attended measure outputs, consists of the average number of active parking season tickets a month respect to the parking spaces offer (Fig.5). Data go back to year 2000 and can be considered sufficient for the creation of a trend curve able to represent a baseline.

The best fitting trend curve has been chosen on the basis of the lowest standard deviation value and the confidence interval has been stated at the 95% confidence level.

The trend curve has been created using historical data on "active season tickets" up to the Operative Phase (October 2011 – distribution to the public of the new cards) (see Graph 2).

Looking at the historical series, data seem to have a more constant trend since year 2002. As regards years 2010 and 2011 a light decrease of the number of season tickets subscriber can be read.

This negative trend could be temporary, it could be caused by external factors, such as the economical crisis. Since summer 2009 and in all 2010 and 2011 Brescia has been characterized by an important contraction of the level of employment with redundancy fund..

BAU scenario has been obtained projecting the historical data trend curve.

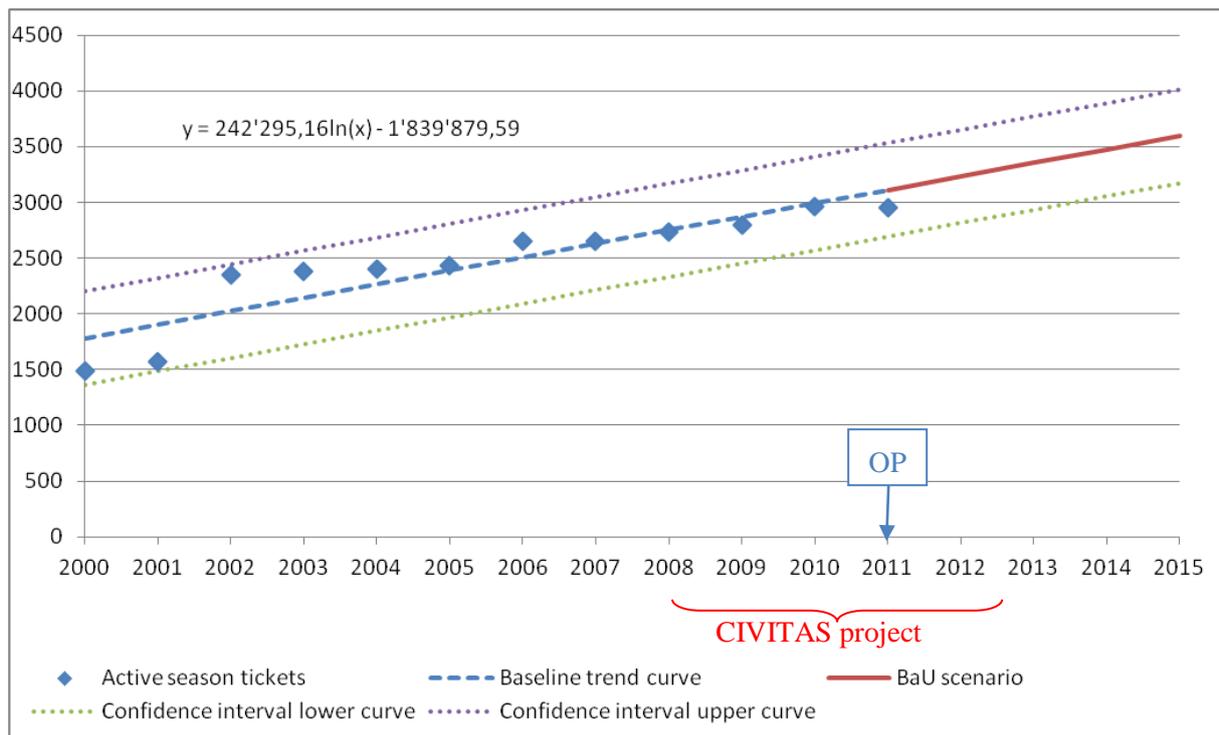


Fig. 5 - BASELINE and BAU scenario for the monthly average number of active season tickets. Trendline built using data up to 2011 (beginning of OP in autumn)

As regard indicator 1 (Percentage of cards validation per year) the historical data series trend curve has been projected to year 2012, and the obtained data can be taken as reference for the BaU scenario in 2012 (See Graph 3).

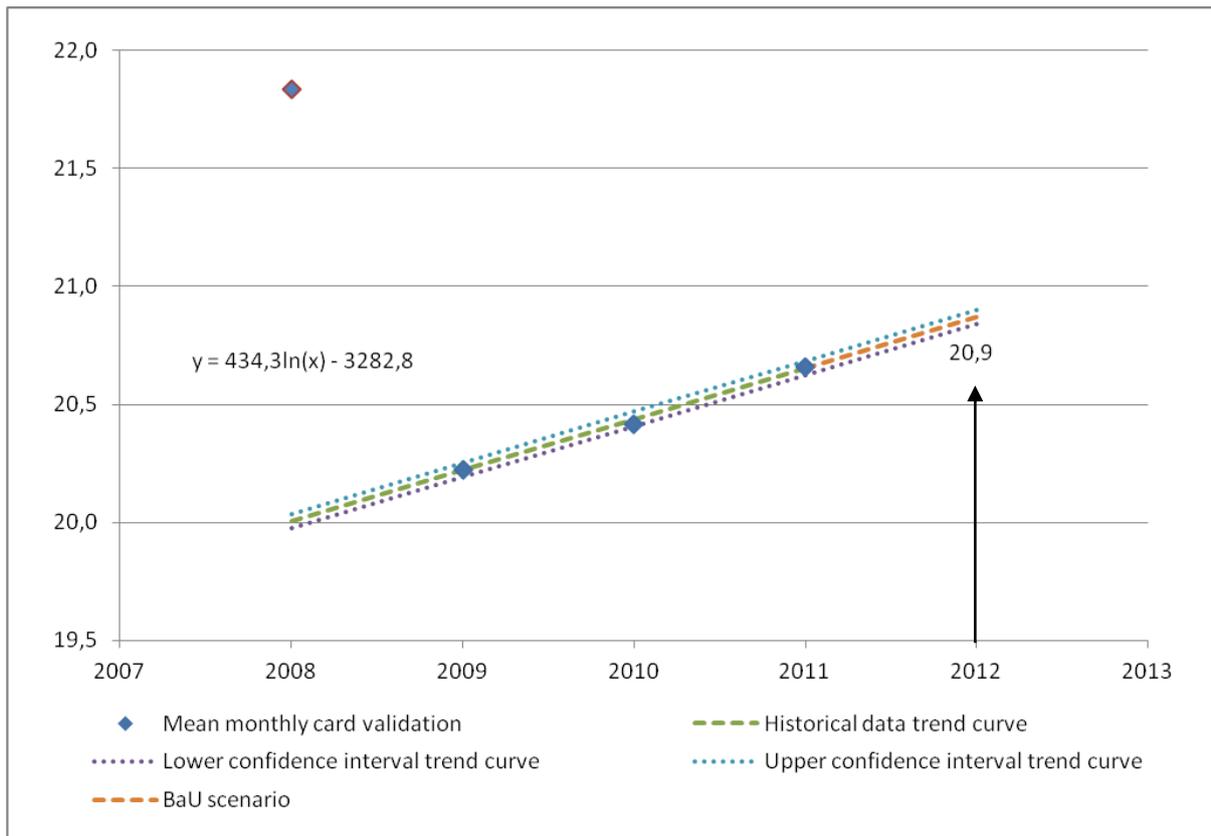


Fig. 6 - BaU scenario for the indicator 1

Indicator	BaU (2012 – before the start up of the metro)
1. Percentage of cards validation per year	20,9 average

Tab.5 - BaU value of indicator1

Tab.5 - BaU value of indicator1

As regards indicator 2.1 (Number of new cards activated with at least 2 season tickets), it has 0 (no service) as BaU value because it's referred to the new cards, distributed during Civitas.

Indicator 3.1 (Number of potential P&R users per day - simulation) was taken from the simulation activity carried out during the implementation of M02.02 "Intermodality with public transport in Brescia".

The scenario aimed to evaluate the potential number of P&R users in the view of the metro start up by 2013.

This simulation activity was done in M02.02 "Intermodality with public transport in Brescia", taking into account:

- the new already designed parking for the Metrobus
- the new Metroline
- the new LPT network

and the results are presented in table n. 6.

It must be underlined that the new parking areas related to P&R for the metro would have been realised as designed anyway, also without Civitas initiative.

Parking	Parking spaces foreseen	Maximum occupancy (%)	Turnover index	Users per day	Peak hour users
Prealpino	435	90%	1,2	522	261

Poliambulanza	266	90%	1,2	319	160
S.Eufemia	500	90%	1,2	600	300

Tab.6 - BaU value of indicator 3.1, from the simulation activities carried out in the Civitas measure M02.02 ("Intermodality with public transport in Brescia")

The Bau value for ind. 3.1 Number of potential P&R users is 1441 users per day.

In order to build BaU for "society" indicators, it should be underlined that giving a look to the baseline of Civitas measure M.02.03 "Development and upgrade of e-ticketing system in Brescia" and in particular to indicators 6 (Awareness) and indicator 7 (Acceptance) which are build to understand the interest of the citizens on multimodal mobility choices introducing a unique card, it is clear that only few people are aware of this possibility.

The following indicators collected in the customer survey for M.02.03 "Development and upgrade of e-ticketing system in Brescia" administered generic questions on multiservice cards – i.e. non specifically dedicated to park and ride service – and they are useful for several considerations in the BaU scenario of this measure.

In particular the following questions were put in May 2011:

- Are you informed on a multi-service card - able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro? (ind 6. Awareness level, M.02.03 "Development and upgrade of e-ticketing system in Brescia")
- Are you interested in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro? (ind. 7 Acceptance M.02.03 "Development and upgrade of e-ticketing system in Brescia")
- Are you favourable to pay a symbolic 5€ key money for the card? (ind. 7 Acceptance M.02.03 "Development and upgrade of e-ticketing system in Brescia")

The BaU scenario for these indicators is the same of the baseline.

As a matter of fact in the Omnibus card (e-ticketing) the P&R season ticket was already included.

Therefore the information can be monitored thanks to the questions asked for M.02.03 "Development and upgrade of e-ticketing system in Brescia" and mentioned above.

<b>Indicators M. 03.03</b>	<b>BaU (2012 – before the start up of the metro)</b>
4. Awareness level	5.1% is aware of the new card distribution in Brescia
5. Acceptance level	<ul style="list-style-type: none"> <li>• 26% of the interviewed would use multi-service card a</li> <li>22% of them is disposed to pay 5€ key money for the card</li> </ul>

Tab.7 - BaU value of indicators 4 and 5

## C2 Measure results

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

### C2.4 Transport

#### • Table C2.4.1: Measure results for the indicators of the category “Transport”

Indicator	Before	After	B-a-U	Difference: After – Before	Difference: After – B-a-U			
1. Percentage of cards validation per year	20,3 (April 2011)	21,2 (after the new card distribution)	20,9 (2012)	+3,6	+0,6			
2. Number of new cards activated with at least 2 subscriptions	Not scheduled	Month	Number of cards with parking +bike sharing both active season tickets	Number of cards with LPT +parking active season tickets	Number of cards with LPT +bike sharing both active season tickets	0 (no service)	Not Assessable	Not Assessable
		mar-12	13	2	351			
		apr-12	14	2	366			
		may-12	14	2	389			
		jun-12	14	2	416			
		jul-12	14	2	416			
		aug-12	14	2	416			
		sep-12	14	2	416			
3. Number of potential P&R users per day (simulation)	Not scheduled	(Scenario 2013) 1.441 P&R users/day	(Scenario 2013) 1.441 P&R users/day	Not Assessable	0			

The indicator 1 "Percentage of cards validation per year" is interesting at local level in order to evaluate the systematic use of parking. This data is useful in order to understand the users' attitude in using structured parking areas. From the data there seem to be a growing interest in such kind of parking.

- The indicator 2.1 “Number of new cards activated with at least 2 subscriptions” was considered useful to evaluate a first attitude of citizens to the intermodal transport. Actually, the P&R service wasn't activated within the end of Civitas project, as the interchange parking will be opened in the occasion of the metro start up by 2013. It was possible to collect information about the number of new Omnibus card with at least 2 active season tickets.
- By the results analysis emerged a promising tendency to the intermodal attitude by the number of cards with LPT +bike sharing both active season tickets: as a matter of fact, the interchange between LPT and bike sharing at the moment is the only one possible - as both these means of transport are available and spread in the city (the first through lines and bus stops, the second through the bike sharing stations).

Indicator 3.1 "Number of potential P&R users per day (simulation)",

Several considerations can be done in relation to potential P&R users:

- the first is related to the assumption the average occupancy of the vehicles was considered 1user/car, therefore the number users is estimated as minimum;
- the second considers the maximum occupancy of the P&R Parking at 90%;
- the third is that the turnover foreseen for parking is low (1.2), as P&R action in systematic mobility is usually related to long lasting period
- The fourth is related to the P&R parking location. Prealpino parking is located in the Northern part of the city and it catches the users coming from the low Valtrompia valley suburbs. Poliambulanza parking is located just outside the “Brescia centro” highway exit. S. Eufemia is located in the South-Eastern part of the city and it catches the user coming from the Garda Lake direction.

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category “Society”**

Indicator	Before	After	B-a-U (2012)	Difference: After – Before	Difference: After – B- a-U
4. Awareness level	(test survey June 2011): 59%	(test survey April 2012): 55,5%	59%	- 3,5	- 3,5
	(customer satisfaction survey May 2011): 5,1%	(customer satisfaction survey November 2011): 44,3%	5,1%	+ 39,2	+ 39,2
5. Acceptance level	(test survey June 2011): 91% (use multi- service card)	(test survey April 2012): 66,5% (use multi- service card)	91%	- 24,5	- 24,5
	(test survey June 2011): 81% (pay	(test survey April 2012):	81%	- 25,5	- 25,5

Indicator	Before	After	B-a-U (2012)	Difference: After – Before	Difference: After – B- a-U
	5€)	55,5% (pay 5€)			
	(customer satisfaction survey May 2011): 26% (use multi- service card)	(customer satisfaction survey November 2011): 22,6% (use multi- service card)	26%	- 3,4	- 3,4
	(customer satisfaction survey May 2011): 22% (pay 5€)	(customer satisfaction survey November 2011): 88,9% (pay 5€)	22%	+ 66,9	+ 66,9

The comparison of the data collected by the specific questions in the customer satisfaction survey, carried out among potential and actual systematic users in Brescia, showed a substantial increase of the awareness and the acceptance about the new Omnibus card distributed. These results are considered important most of all in the view of the next metro and the interchange parking start up by 2013.

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Development of a new SW functionality for the Automatic Fare Collection (AFC) management system to treat Park & Ride services; <i>The SW able to manage the P&amp;R system has been developed. The test phase has been carried out in September 2011; therefore this objective can be considered almost achieved in full.</i>	<b>**</b>
2	Development of a new HW platform for Park & Ride gates and ticketing machines <i>The upgrade of the existing HW platform for Park &amp; Ride has been reached in terms of technology development (Omnibus cards, double face tickets); even if the actual Interchange parking won't be built within Civitas. Therefore, this objective can be considered almost achieved in full.</i>	<b>**</b>
3	Creation of interoperability between public transport services and parking services <i>During the Civitas project, in addition to the new designed and realized Omnibus Card, it was possible to update the ticketing system for the parking users and to test a new integrated technology (SW and hw), with new double face tickets for occasional parking users. As a matter of fact, the interoperability between parking and LPT is possible, not only thanks to the new Omnibus card, which collects several services (parking, LPT, bike sharing), but also to the double face tickets (if the user take the LPT, there will be a reduced fare), which were prototyped and internal tested by Brescia Mobilità.</i>	<b>**</b>
4	The purchase/distribution of at least 1.000 new card (Mifare 1K or Mifare 4K) supporting also the new P&R service	<b>***</b>

	<i>Over 7000 4k Mifare cards have been distributed up to now to parking, bike sharing and LPT users.</i>	
<b>5</b>	The definition of new typologies of fares for Park & Ride services <i>At the moment the discussion among the involved partners is on going about the P&amp;R fares and it seems to be difficult to reach an agreement within the end of Civitas.</i>	<b>O</b>
<b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b> <b>** = Achieved in full    *** = Exceeded</b>		

#### C4 Up-scaling of results

The measure is already extended to the entire city and its suburbs served by PT network therefore no up scaling is possible.

#### C5 Appraisal of evaluation approach

The evaluation approach was based on the project’s objective as expressed explicitly in the Evaluation Plan. From the evaluation point of view, this measure consisted mainly in research and demonstration activities, related to the technological development of ticket machines and double face tickets to be used by occasional users for P&R. Therefore the indicators belonging to “Transport” and “Society” categories should be considered as complementary indicators in order to evaluate the potentiality of P&R implementation in Brescia.

- Indicator 1 ("Percentage of cards validation per year") monitored the systematic (season) users of parking.

- indicator 2.1 ("Number of new cards activated with at least 2 season tickets"), provided an initial evaluation of the citizens attitude to intermodality, monitoring Omnibus card users of Bike Sharing/Parking and/or of Bike Sharing/buses and/or of Parking/buses.

- Indicator 3.1 "Number of potential P&R users per day (simulation) was based on a simulation model (CUBE), taking into account the future metro line and the location of the interchange parking.

Simulation activities took into consideration parking capacity that is strictly related to an effective Park & Ride implementation.

The indicators of the "Society" category were chosen to monitor the awareness and the acceptance of systematic users toward Omnibus card distribution that manages also Parking subscribers.

#### C6 Summary of evaluation results

The key results are as follows:

- **Key result 1** – The development of a new SW functionality for the Automatic Fare Collection (AFC) management system to treat Park & Ride services and a new HW platform for Park & Ride gates and ticketing machines are two complementary and fundamental achieved goals for the city of Brescia. In fact, for occasional users the interchange between private and public transport would be possible using only one integrated ticket. Furthermore also systematic users can count on the availability of Omnibus card (i.e. integrated PT transport card, e-ticketing, developed in M. 02.03 "Development and upgrade of e-ticketing system in Brescia").
- **Key result 2** – The upgrade of the HW and SW able to read double face tickets for P&R services was prototyped and tested during Civitas project. The actual use of these tickets will begin with the start up of the Metrobus by 2013,

- **Key result 3** - New ticket machines to be installed in interchange parking have already been ordered by Brescia Mobilità. From the test phase results, the service was considered completely reliable because no breakings or system errors were experienced in that period of time.

### **C7 Future activities relating to the measure**

All the SW and HW of the parking machines of the city will be equipped to read double face tickets.

Info updated after the final submission of the MERT in October 2012 and already reported in the Annex A of the measure (POINTER revision received on December 2013):

The introduction of P&R led to an integration of fares. In order to define the fares, several parking/public transport fare systems applied in a number of European cities were analysed. A first fares hypothesis was explored in November 2012, as before it was necessary to define how much “virtual space” was necessary to store all the information needed to apply the fares themselves (for LPT or for LPT+parking).

At the beginning of December 2012 several fares for P&R facilities were submitted to the Municipality of Brescia, for the approval.

STANDARD PARKING FEES – <b>ONLY PARKING</b> (applicable when the Metrobus is not used)		INTEGRATED FARE <b>PARKING + METROBUS</b> (applicable when Metrobus is used)			
		Concession <b>PARKING</b> fee		METROBUS Parking fee	
<i>hourly parking fee (occasional users)</i>		<i>hourly parking fee (occasional users)</i>		<i>Metrobus ticket fare</i>	
From 1 <sup>st</sup> to 4 <sup>th</sup> hour or part thereof	€ 1.00/hour	from 1 <sup>st</sup> to 4 <sup>th</sup> hour or part thereof	€ 0.30/hour	Single journey up to 75 minutes	€ 1.20
5 <sup>th</sup> and 6 <sup>th</sup> hour or part thereof	€ 0.80/hour	Flat rate from 4 <sup>th</sup> to 24 <sup>th</sup> hour (max daily fee)	€ 1.60		
Flat rate from 6 <sup>th</sup> to 24 <sup>th</sup> hour (max daily fee)	€ 6.00				
<i>parking season tickets</i>		<i>parking season tickets</i>		<i>Metrobus season ticket</i>	
24/24	€ 50.00/month				
24/24	€ 500.00/year				
Daily	€ 30.00/month	Daily	€ 15.00/month	unlimited travel	€ 32.00/month
Daily	€ 75.00/quarter	Daily	€ 40.00/quarter	unlimited travel	€ 93.00/quarter
Daily	€ 300.00/year	Daily	€ 160.00/year	unlimited travel	€ 276.00/year
<b>P&amp;R integrated fares</b>					

Parking stay	Parking fee	<u>Integrated</u> fare parking + 1 METROBUS JOURNEY(€ 1.20)	<u>Integrated</u> fare PARKING + 2 METROBUS JOURNEYS (€ 2.40)	Integrated fare PARKING + 3 METROBUS JOURNEYS (€ 3.60)
1 hour	€ 0.30	€ 1.50	€ 2.70	€ 3.90
2 hours	€ 0.60	€ 1.80	€ 3.00	€ 4.20
3 hours	€ 0.90	€ 2.10	€ 3.30	€ 4.50
4 hours	€ 1.20	€ 2.40	€ 3.60	€ 4.80
From 5 to 24 h	€ 1.60	€ 2.80	€ 4.00	€ 5.20
<b>P&amp;R integrated fares and journeys</b>				

## D. Process Evaluation Findings

### D.0 Focused measure

This measure is not a focused one.

### D1 Deviations from the original plan

- **Test phase replaced the demo activity for double face tickets** - at the beginning of Civitas project, it was proposed to experiment the interoperability of the new double face tickets (realized for occasional users to use P&R service) in a demo area; in particular, a parking and a bus line (existing or specially organized) had to be pointed out and the new HW-SW supports of parking small columns had to be installed. The demonstration wasn't done, because of some problems related to the new technology development. Therefore, the end of the measure was extended in order to finalize an internal test phase. The test was successfully carried out by Brescia Mobilità together with the HW provider and the functioning of the new supports was also monitored.

### D2 Barriers and drivers

#### D2.1 Barriers

.In the sequel main barriers, which have been experienced during the measure implementation, are pointed out:

##### Preparation phase

- **Organizational barrier** - some problems emerged during the first phase of the measure implementation, due to a lack of communication among Brescia Mobilità, tickets supplier and the stamping system supplier of the parking. As a matter of fact suppliers didn't want to upgrade the ticketing system that was needed by the city to reach an effective and integrated public transport.

##### Implementation phase

- **Technical barrier** - there was a technological problem concerning the machines which had to read and punch the new double face ticket developed for occasional users (P&R).

The readability problem was caused by the presence of two different kinds of ticket reader machines (one for parking and the other for LPT). The new ticket has a thermal paper on one side for the parking service and a magnetic stripe on the other for the public transport. This solution allowed the P&R using only one ticket, with acceptable costs for the citizens. This kind of problem didn't regard the new contactless Omnibus Card.

**Technical barrier** - Another problem related to the use of a single ticket was the computation of different fares applied for parking and LPT (Rides). Therefore special attention was paid to the system configuration for the management of different fares and for the computation of the

effective amount due to the customer (a single card deals services managed by different companies).

### **Operational phase**

**Political/strategic barrier** - some problems had been encountered as regards the definition of the new kind of fares, linked with the use/non use of P&R service. This step had to be shared between Brescia Municipality, Brescia Mobilità (representing LPT) and Sintesi (representing parking). While the technical aspect seem to be solved, the final fares to be applied have not been decided yet.

## **D2.2 Drivers**

In the sequel main drivers, which have been picked out during the measure implementation, are pointed out:

### **Preparation phase**

- **Financial driver** - considering that the city of Brescia had been traditionally a mono-modal transport city, the availability of Civitas funds allowed the city of Brescia to promote more intermodal attitude of the citizens, integrating the LPT service (metrobus – start up by 2013 - and buses) with the interchange parking built to catch potential Metrobus users through not only the new contactless Omnibus Card for systematic users, but also a new double face ticketing system for occasional ones.

## **D2.3 Activities**

### **Implementation phase**

- **Collaboration to solve technological problems** - The activity consisted in the promotion by Brescia Mobilità of a strict collaboration with the provider of double face tickets and of the parking punching machines provider, in order to create the HW and SW to support double face tickets developed for occasional P&R users
- **Target group organization** - The activity consisted in the organization of the Target Group, involving the Measure Leaders, responsible for measures which were part of the Metro Package (M02.02 "Intermodality with PT in Brescia", M02.03 "Development and upgrade of the e-ticketing system in Brescia", M08.05 "Brescia Mobile Channel"), in order to share information on
  - The new Omnibus card outputs crosswise
  - The kind of season ticket loaded on the cards
  - The use subscribers made of it and
  - The number of potential Park & Ride users.

Thanks to the Target group, it was also possible to deepen hypothesis related to the "metro package" and to the future mobility asset of the city in general.

### **Operational phase**

- **Definition of new fares** - The activity consisted in the promotion of a strict collaboration among Municipality of Brescia, Brescia Mobilità and Sintesi, in order to share information and decision about the fares to be applied for P&R using Omnibus card and double face tickets.

## **D3 Participation**

### **D.3.1 Measure partners**

- **Municipality of Brescia** - the partnership was important in order to choose the kind of technological support, able to manage information about the different codes, each one associated to a particular kind of fares.
- **Sintesi s.p.a** - the society, which manage the parking in Brescia, was an important partner, as it collaborated to the update and test phase of the new HW and SW both for new contactless Omnibus card and double face tickets.

### **D.3.2 Stakeholders**

- **Parking users** - were involved in a questionnaire in April 2012 on future P&R service and the new Omnibus card.
- **HW and SW system suppliers both of new contactless Omnibus Card and of new double face tickets** - the suppliers were involved in the upgrade of the new parking HW and SW system. Their collaboration was considered fundamental to solve all problems related to compatibility of different kind of technologies used by each supplier.

## **D4 Recommendations**

### **D.4.1 Recommendations: measure replication**

- **Collaboration among suppliers** - a strict collaboration among the supplier of different technological supports is necessary, when you want to integrate different technological systems. As a matter of fact, HW design must keep pace with SW realization.
- **Upgrade parking system for P&R** –The system update need to be able to manage both occasional and systematic users, in order to better implement the P&R service.
- **Importance of test phase** – foresee internal testing phases while developing a new technology. This allows controlling the possible breaks or SW/HW problems.

### **D.4.2 Recommendations: process**

- **Recommendation 1** – the collaboration among partners is important, also to choose the most suitable technology for the P&R needs of the city. As a matter of fact, the information management requires technological development and support (as Omnibus card or double face card) but also political choices related to the fares definition. As a matter of fact a wrong fare definition could affect the success of P&R action.

## Annex 1: Historical data series for the BaU calculation

- **Indicator 1** (*Percentage of cards validation per year*) – The existing P&R system users can be divided into two categories: season tickets holders (who use a contactless card) and occasional users (who use a bar code ticket). The calculation of this indicator can be made dividing the total number of season tickets validations in regulated car parking by the total number of valid season tickets. The ex ante situation is referred to the period previous to the new contactless card distribution (Mifare cards) scheduled in September 2011, according to the progress in the implementation of the measure 02.03 (e-ticketing). Data are provided by the company “SINTESI S.p.A.” that manages the parking system in Brescia.

### Historical data series:

Month	A Number of season tickets validation	B Number of active contactless season tickets	Indicator 1 (A/B)
jan-08	63699	2667	23,9
feb-08	61287	2680	22,9
mar-08	61042	2672	22,8
apr-08	63557	2699	23,5
may-08	64528	2696	23,9
jun-08	57112	2595	22,0
jul-08	58121	2740	21,2
aug-08	39377	2666	14,8
sep-08	61143	2760	22,2
oct-08	67538	2821	23,9
nov-08	61243	2851	21,5
dec-08	56581	2921	19,4
jan-09	40956	1864	22,0
feb-09	59119	2940	20,1
mar-09	63276	2950	21,4
apr-09	60385	2920	20,7
may-09	58584	2912	20,1
jun-09	56575	2864	19,8
jul-09	55942	2835	19,7
aug-09	39110	2691	14,5
sep-09	59842	2759	21,7
oct-09	64248	2959	21,7
nov-09	62987	2922	21,6
dec-09	56849	2928	19,4
jan-10	57187	2926	19,5
feb-10	58761	2958	19,9

mar-10	68609	2936	23,4
apr-10	62363	2984	20,9
may-10	62936	2961	21,3
jun-10	59553	2944	20,2
jul-10	56690	2899	19,6
aug-10	42549	2863	14,9
sep-10	62872	2867	21,9
oct-10	65644	3003	21,9
nov-10	65740	3076	21,4
dec-10	62607	3113	20,1
jan-11	59740	3049	19,6
feb-11	58650	3023	19,4
mar-11	67706	3029	22,4
apr-11	60698	2994	20,3
may-11	65695	3003	21,9
jun-11	59705	2970	20,1
jul-11	54965	2631	20,9
A = Number of validations of contactless season tickets B = Number of active contactless season tickets			

Tab.A1.1: Percentage of cards validation per year: historical series

- **Indicator 4 (Awareness level)** According to the progress in the implementation of the measure 02.03 (e-ticketing), a consistent number of new cards will be distributed in September 2011.

By the end of April 2011 a Focus Group has been arranged to better understand the interest towards P&R solutions in Brescia and towards its awareness in relation to the potential offered by the integration of transport fare system. In particular, the situation concerning the increasing number of multi-service cards and their potentials in mobility applications will be presented. The meeting has been an occasion to prepare the questionnaire to be administered to P&R potential users in order to collect this indicator after the new cards distribution (foreseen in September 2011).

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be soon introduced?"	59%	41%	100%
With such a card, would you be more disposed to make the best use of P&R service (intermodality Parking – Local Public Transport)?	91%	9%	100%
Do you have knowledge of other cities which introduced similar cards?	19%	81%	100%
Would you be disposed to pay a symbolic key money (5€) for this new card?	81%	19%	100%

Tab.A1.2: Awareness level

The question of the questionnaire able to express the indicator n.4 is the first one, namely:

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be soon introduced?"	59%	41%	100%

Tab.A1.3: Awareness level

From Measure 02.03:

(*Awareness level-Indicator 6* (May 2011)) -

**EX ANTE SITUATION**

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon in Brescia?"	5,1%	94,9%	100%

Tab.A1.4: Awareness level

- **Indicator 5** (*Acceptance level*) - Taking as reference the same methodology/details described for the indicator n.4, the level of acceptance can be expressed by the questions n. 2 and 4, namely:

	YES	NO	Totals
With such a card, would you be more disposed to make the best use of P&R service (intermodality Parking – Local Public Transport)?	91%	9%	100%
Would you be disposed to pay a symbolic key money (5€) for this new card?	81%	19%	100%

Tab.A1.5: Acceptance level

From Measure 02.03:

**EX ANTE SITUATION** is referred to the period previous to the cards distribution, therefore, during the May 2011 survey, a specific question for the collection of this indicator has been inserted, namely:

	YES	NO	Totals
Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?	26%	74%	100%
Would you be favourably disposed towards the payment of a symbolic 5€ key money?	22,1%	77,9%	100%

Tab.A1.6: Acceptance level

## Annex 2: Ex ante and Ex Post data collection

- Indicator 1** (*Percentage of cards validation per year*) – The existing P&R system users can be divided into two categories: season tickets holders (who use a contactless card) and occasional users (who use a bar code ticket). The calculation of this indicator can be made dividing the total number of season tickets validations in regulated car parking by the total number of valid season tickets. The ex ante situation is referred to the period previous to the new contactless card distribution (Mifare cards) scheduled in September 2011, according to the progress in the implementation of the measure 02.03 (e-ticketing). Data are provided by the company “SINTESI S.p.A.” that manages the parking system in Brescia.

### Ex ante situation (April 2011)

A = Number of validations of contactless season tickets = 60.698

B = Number of active contactless season tickets = 2.994

**Indicator 1 = A/B = 20,3**

### Ex post situation

Month	A Number of season tickets validation	B Number of active contactless season tickets	Indicator 1 (A/B)
nov-11	56.662	2.612	21,69
dec-11	50.374	2.601	19,36
jan-12	51.970	2.574	20,19
feb-12	50.576	2.569	19,68
mar-12	53.586	2.574	20,81
Apr-12	62.506	2.607	23,98
Mag-12	68.463	2.996	22,85
Giu-12	67.920	2.934	23,15
Lug-12	65.012	2.866	22,68
Ago-12	49.098	2.785	17,63
A = Number of validations of contactless season tickets B = Number of active contactless season tickets			

Tab.A2.1: Percentage of cards validation per year

- Indicator 2.1** (*Number of new cards activated with at least 2 season tickets*)

Month	Number of cards with LPT+bike sharing both active season tickets	Number of cards with parking+bike sharing both active season tickets	Number of cards with LPT+parking active season tickets

mar-12	351	13	2
apr-12	366	14	2
may-12	389	14	2
jun-12	416	14	2
jul-12	416	14	2
aug-12	416	14	2
sep-12	416	14	2

Tab.A2.2: Number of new cards activated with at least 2 season tickets

- **Indicator 3** (Number of interchanges per km of trip) **NO MORE COLLECTED**
- **Indicator 3.1** (*Number of potential P&R users per day (simulation)*) - P&R structures won't be ready before the Metro start up, therefore this indicator is calculated basing on a simulation model (CUBE). The scenario takes into account the future metro line and the location of the interchange parking (that have already been designed). Simulation activities take into consideration also the parking capacity that is strictly related to the selected area. Indicator values have been taken from the simulation activity carried out during the Civitas measure implementation M02.02 ("Intermodality with public transport in Brescia"). The scenarios aimed to reorganize the potential P&R users in the view of the metro start up (2013),
- 1<sup>th</sup> data collection referred to scenarios developed in M02.02 (data collection in February 2012):

	Parking spaces foreseen	Maximum occupancy (%)	Turnover index	Users per day	Peak hour users
Prealpino	435	90%	1,2	522	261
Poliambulanza	266	90%	1,2	319	160
S.Eufemia	500	90%	1,2	600	300
Indicator 3.1	1.441 potential park and ride users per day				

Tab.A2.3: Number of potential P&amp;R interchanges per km of trip (simulation among different scenarios)

- **Indicator 4** (*Awareness level*) According to the progress in the implementation of the measure 02.03 (e-ticketing), a consistent number of new cards has been distributed in September 2011.

In order to have an idea of the ex ante situation, a questionnaire has been administered in June 2011 (before the new cards distribution) as "test survey" to a total of 32 people.

The ex post situation could be collected since one month after the new cards distribution, but in order to obtain more consistent results, probably, questionnaires will be administered after October 2011 to the Parking service season tickets subscribers.

An interesting source of information about the aptitude towards the multi service cards introduction and the integration of different transport solutions can also derive from the specific question inserted in the customer satisfaction in occasion of the collection of some M02.03 indicators. The specific question is the following:

“Would you be interested in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro?”

**EX ANTE SITUATION (Test survey June 2011)**

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be soon introduced?”	19	13	32
	59%	41%	100%
With such a card, would you be more disposed to make the best use of P&R service (intermodality Parking – Local Public Transport)?	29	3	32
	91%	9%	100%
Do you have knowledge of other cities which introduced similar cards?	6	26	32
	19%	81%	100%
Would you be disposed to pay a symbolic key money (5€) for this new card?	26	6	32
	81%	19%	100%

Tab.A2.4: awareness level

The question of the questionnaire (test survey) able to express the indicator n.4 is the first one, namely:

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be soon introduced?”	19	13	32
	59%	41%	100%

Tab.A2.5: awareness level

**EX ANTE SITUATION:** the data comes from the Customer satisfaction survey carried out in May 2011 for the Measure 02.03 (“Development and upgrade of the e-ticketing system in Brescia”)

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon in Brescia?”	5,1%	94,9%	100%
“Would you be interested in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro?”	26,0%	74,0%	100%

Tab.A2.6: awareness level

**AFTER SITUATION (Test survey results April 2012): 155 questionnaires**

	YES	NO	Total (also considering the not answered questions)
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) has been introduced?”	86	68	155
	55,5%	43,8%	
With such a card, would you be more disposed to make the best use of	103	46	155

P&R service (intermodality Parking – Local Public Transport)?	66,5%	29,7%	
Do you have knowledge of other cities which introduced similar cards?	26	127	155
	16,8%	82%	
Would you be disposed to pay a symbolic key money (5€) for this new card?	86	61	155
	55,5%	39,4%	

Tab.A2.7: awareness level

**AFTER SITUATION:** the data comes from the Customer satisfaction survey carried out in November 2011 for the Measure 02.03 (“Development and upgrade of the e-ticketing system in Brescia”)

	YES	NO	Totals
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is available in Brescia?”	44,3%	55,7%	100%
“Would you be interested in a multi-service card able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro?”	22,6%	77,4%	100%

Tab.A2.8: awareness level

- **Indicator 5 (Acceptance level)** - Taking as reference the same methodology/details described for the indicator n.4, the level of acceptance can be expressed by the questions n. 2 and 4 (test survey June 2011), namely:

EX ANTE SITUATION (Test survey June 2011)

	YES	NO	Totals
With such a card, would you be more disposed to make the best use of P&R service (intermodality Parking – Local Public Transport)?	29	3	32
	91%	9%	100%
Would you be disposed to pay a symbolic key money (5€) for this new card?	26	6	32
	81%	19%	100%

Tab.A2.9: acceptance level

**EX ANTE SITUATION:** the data comes from the Customer satisfaction survey carried out in May 2011 for the Measure 02.03 (“Development and upgrade of the e-ticketing system in Brescia”)

	YES	NO	Totals

Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?	26%	74%	100%
Would you be favourably disposed towards the payment of a symbolic 5€ key money?	22,1%	77,9%	100%

Tab.A2.10: acceptance level

**AFTER SITUATION** (Test survey results April 2012): 155 questionnaires

	YES	NO	Total (also considering the not answered questions)
Do you know that in Brescia a new multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) has been introduced?"	86 55,5%	68 43,8%	155
Would you be disposed to pay a symbolic key money (5€) for this new card?	86 55,5%	61 39,4%	155

Tab.A2.11: acceptance level

**AFTER SITUATION:** the data comes from the Customer satisfaction survey carried out in November 2011 for the Measure 02.03 (“Development and upgrade of the e-ticketing system in Brescia”)

	YES	NO	Totals
Would you be interested in a multi-service card (able to manage, beside LPT season tickets, many other services such as Bike Sharing, Parking and the future Metro) is going to be distributed soon?	22,6%	77,4%	100%
Would you be favourably disposed towards the payment of a symbolic 5€ key money?	88,9%	11,1%	100%

Tab.A2.12: acceptance level

## Annex 3: Focus Group Activities

	Brescia University	FOCUS GROUP ACTIVITIES	CIVITAS MODERN
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<b>Title</b>	<b>Impostazione dei Focus Group</b>
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità

STEP 1	<b>Accoglienza e riscaldamento (circa 10 minuti)</b>		
	1) Presentazione degli invitati al gruppo di discussione. 2) Presentazione dei ricercatori.		
STEP 2	<b>Introduzione al tema della discussione (circa 10 minuti)</b>		
	3) Motivazione e condizioni (fasi e tempi) dell'incontro di gruppo in data _____ - Metro Package (MP); - lighthouse measures; - indicatori.		
STEP 3	4) Gli obiettivi dell'incontro sono: - condivisione metodologia per lo svolgimento del Focus Group; - attuazione del Focus Group.		
	<b>Fasi della ricerca: descrittiva, riflessiva e propositiva</b>		
	<b>TEMA</b>	<b>MISURA</b>	<b>METROPACKAGE</b>
	Azzeramento della conoscenza e condivisione degli input (ipotesi scenari)		
	Potere decisionale in relazione al tipo di scelta da attuare		
	Percezione di rischi/problematichette oltre Civitas (ad esempio, entrata in esercizio della metro)		
	Ruolo di ciascun intervento per il funzionamento del MP: - bike sharing; - parcheggi; - BMC; - intermodalità; - e-ticketing; - politiche di tariffazione; - gestione della mobilità.		
STEP 4	<b>Verifica di fattibilità e scelta finale</b>		
STEP 5	<b>Assegnazione dei ruoli</b>		
STEP 6	<b>Sintesi dei risultati:</b>		
	- per singola misura; - per Metro Package		

Tab.A3.1: General structure of the Focus Group activities

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>	<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità		
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>	
Date: <b>15 november 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari	
	BSM	Sbardella, Gussago, Ragnoli, Pace	
	BST	Sutera	
	CBS	Bresciani	
	BICIMIA	Verità	
<b>Main topics</b>	1) Scambio ERT tra i vari Partner per condividere le attività previste nelle diverse misure; 2) Rivedere i contenuti insieme, in modo da avere COERENZA nella descrizione delle misure; 3) Prevedere un rimando corretto e concordato in tutte le misure collegate (es. 02.02 e 02.03); 4) Coinvolgimento Bicimia (geom. Verità) per testare l'efficacia della distribuzione delle tessere OMNIBUS e il loro funzionamento per gestione P&R (verificare tracciabilità dei dati) e scegliere un Parcheggio + BICIMIA (x es. in centro), dove si hanno dati e uso della OMNIBUS 5) considerare solo timbrature e uso delle OMNIBUS (no altre carte!!!) 6) necessità di ricevere (dal CBS??) una tavola con la localizzazione dei Parcheggi per la Metropolitana e il numero degli stalli (deve essere base condivisa!!!) 7) usare modello di BSM come previsto nella M02.02 8) concentrarsi anche solo su uno scenario, Parcheggio e analizzarlo benissimo!! 9) portare dati e info al prossimo incontro (15 dicembre) 10) rendicontare questa attività nel Process Evaluation Form (Focus, coordinamento e condivisione) 11) vedere indicatori delle misure, in particolare quelli legati alla simulazione metropolitana e collaborare per la raccolta (usare modello della M02.02)		
	Prossimo incontro fissato per il 19 Dicembre 2011 a Brescia Mobilità		

Tab.A3.1: Focus Group activities – Convocation of the 1th meeting (15 November 2011)

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
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<b>Title</b>	<b>Impostazione dei Focus Group</b>	
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel	
<b>Other stakeholders</b>	- Brescia Municipality - Sutura - Verità	
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>
<b>Date: 19 dicembre 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari
	BSM	Sbardella, Gussago, Ragnoli, Pace
	CBS	Bresciani

<b>Main topics</b>	1) Verifica dello scambio dei dati di input per la coerenza degli scenari per i parcheggi; 2) inquadramento delle misure M02.03 e M08.05 (in qualità di possibili lighthouse measures) all'interno del Metro Package; 3) cronogramma della M02.03; 4) soluzioni trovate per la registrazione dell'utilizzo del servizio P&R per gli utenti occasionali (sistemi, fornitura, test); 5) determinazione e consapevolezza della capacità decisionale che il ML ha come responsabile della misura; 6) analisi della percezione di rischi/problematiche oltre Civitas; 7) definizione del ruolo del Mobility Manager all'interno del Focus Group 8) proposta dell'organizzazione di un Focus Group aperto al pubblico (individuando persone da coinvolgere) per avere opinioni e aspettative da parte dell'utenza in merito a bike sharing, parcheggi, BMC, ecc., da considerarsi come azione di dissemination
	Prossimo incontro possibile: prima della riunione tecnica di febbraio

Tab.A3.1: Focus Group activities – Convocation of the 2<sup>nd</sup> meeting (19 December 2011)

## **M04.01 – Executive summary**

To improve the transport company (Brescia Trasporti) constant care for travellers' needs means to increase the attention to the information dissemination about the public transport products. This is very particularly during the phase of Metro construction, because of the routes changes due to the work in progress on the roads.

LPT bus network is going to be radically reorganized by 2013, as metro-line has just being built (start up by 2013) and it will become the most important line of the PT network (that crosses the town from north to south-east). Mobility marketing actions developed in this measure consisted in dissemination campaigns related to Local Public Transport (LPT) service (urban buses) in the city of Brescia. The measure aimed at increasing the level of information in order to promote public transport mainly improving accessibility to LPT timetables and to LPT maps. Several dissemination activities were made through the distribution of a range of renewed products.

The renewing of the marketing merchandise has been focused on the following features:

- readability (clear and sharp information was used)
- fonts dimensions (new and bigger showcases were installed, to allow the use of bigger fonts)
- contents (different info if on the web, in timetables, etc..)
- languages (timetables have been translated in English, French and Russian)

This choice was mainly due to the fact that city users are changing their needs. As multiethnic groups are growing in number and they can be considered all potential PT users the offer should be shaped on their habits.

A set of indicators have been measured to monitor the objectives achievement and to check the general quality of information spread among citizens and the awareness/acceptance levels about the new designed booklet and information.

A massive targeted distribution leaflets and booklets to 13 years old student was done in 2011. In 2008, 2009, 2010 also other communication channels have been used, like newspapers and websites in order spread info about Brescia Local Public Transport service over the majority of citizens.

Thanks to the implementation of integrated and effective actions mainly concentrated in two time periods (September and June) of the year and repeated every year of the project, more than 80% of the students attending junior high schools were reached by the targeted information campaign and more than 52% of citizens living in the area where PT service information has been spread have been reached by the marketing campaigns.

Then, to replicate the measure it is important to optimise the information channels already available by choosing to use consolidated advertisements means. On the other hand it is fundamental to disseminate information among citizens also through the production of new and targeted material (i.e. redesign of the timetables, info packs for kids.)

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(P) High level / longer term:

- To stimulate people to use public transport and to promote PT service.

(Q) Strategic level:

- To increase the level of the information about PT (accessibility and up-grade) in order to promote public transport and to rationalize and improve the accessibility of the service.

(R) Measure level:

- (1). To reach at least 30% of the citizens of the served area with the PT service information, that consist in communication objects (maps and timetables), information at bus stops and glass showcases (equipping the existing ones or installing them in every town district)
- (2). To reach about the 80% of the student registered for the school year in progress, with targeted information about PT service. Particular attention is given to 13 years old kids.

### **A2 Description**

This measure consisted mainly of dissemination activities in order to promote the PT service in Brescia, i.e. the distribution of redesigned information products dealing with public transport (timetables and maps) and the implementation and renewal of glass showcases and improve web resources. The information campaigns were addressed to those citizens who already use the LPT but also to the potential users, paying attention to improving the information accessibility and quality.

A good dissemination of information is fundamental in order to help citizens to approach LPT: as a matter of fact, potential users could be discouraged and frustrated from either a lack or a scarce readability of the provided information about LPT services. This means that the attention in improving information in order to make it clear and easy to find and to understand is crucial to spread the PT culture among citizens.

Also a constant and well-timed information upgrade is usually appreciated in order to assure a high level of quality and efficiency of the service. As we know, the easy access to upgraded and clear information reduces the distances between citizens and PT service.

Mainly for the considerations reported above, this measure scheduled 3 main activities concerning the rationalization and the improvement of the PT information accessibility/quality, namely:

- New timetable layout distributed through booklet, leaflets and webpages translated into several languages (English, French and Russian) (Fig. 1) and realization of targeted info

packs. A particular attention was given to the information concerning the school bus service addressed to young PT users (13 years old) (Fig. 2).



Fig. 1: Leaflets translated in several languages (English, French and Russian).

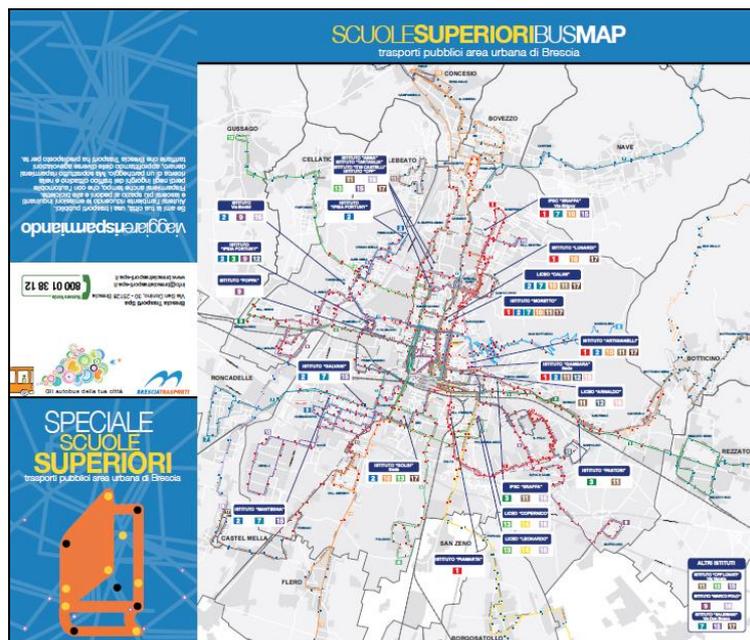


Fig. 2: Targeted information campaign to young PT users

- Installation of new glass showcases in every town district and requalification of some bus stops through the installation of new bus shelters foreseeing also specific spaces for the information about LPT, such as posters and maps (Fig. 3 and 4);



Fig. 3 LPT information poster (common to all the showcases or bus shelters)

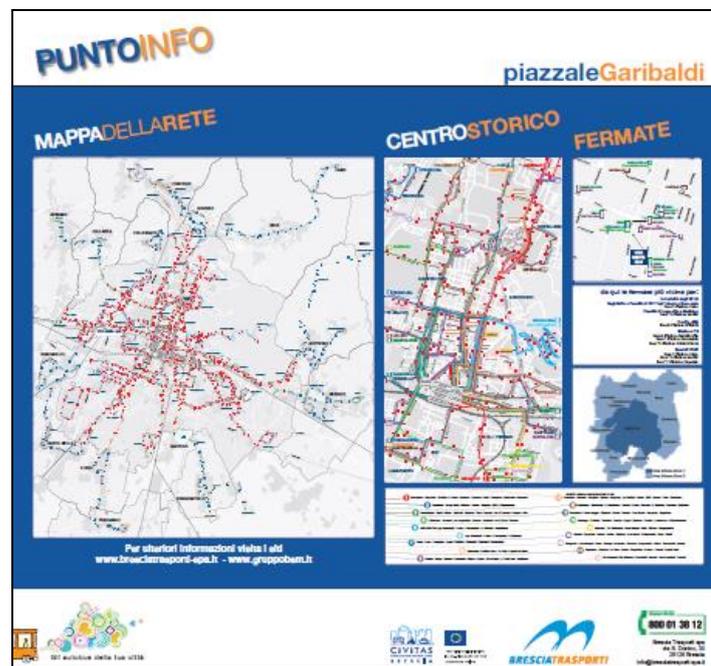


Fig. 4: Poster dedicated to each single bus stop reporting details about the stop, ticket resellers and “where are you”

- Re-design of the information on board of the buses.

This activity took for granted the Check of the correct application of the standards of put information on board. An example of the stickers posted on board is reported in the following picture.



*Fig. 5 Positioning of the new version of “Sell of tickets on board” sticker on board*

During the project has been preferred to publish on web, also dynamic information.

## **B. Measure implementation**

### **B1 Innovative aspects**

This measure didn't bring effective "innovative" solutions, but it's possible to consider the undertaken actions innovative for the Brescia cultural background. The innovative aspects of the measure were:

- New conceptual approach
- Targeting specific user groups

In particular:

- **Innovative aspect 1 (New conceptual approach)** – The new approach in leading the campaigns was based on the spread of renewed timetables, leaflets and maps translated into several languages (English, French and Russian). This choice derived from the necessity to improve the accessibility to the information about LPT for foreigners. As a matter of fact, besides tourists, in Brescia several ethnic groups are present and they were considered as potential PT users to be favoured;
- **Innovative aspect 2 (Targeting specific user groups)** – Even if the information campaigns were addressed to PT users in general (passengers, potential demand and stakeholders) a particular attention was given to young PT users (13 years old students). In particular, specific leaflets/maps were produced and distributed to the students attending 3rd classes of the middle school, in order to inform them about dedicated fares and about the localization of the high schools that can be reached by PT network.

### **B2 Research and Technology Development**

Starting from the customer satisfaction survey (that BST traditionally carries out every 4months interviewing a sample size of 1200 people among the PT users), the RTD activities consisted in analysing the results of the surveys in order to decide the best solution to improve the readability/accessibility of the info items (timetables, maps, stickers on board, etc.), in terms of completeness, complexity, dimension, level of update, according to the passenger's needs.

Research activities were related to the following topics:

- definition of the places where showcases had to be installed, in collaboration with Brescia Municipality;
- analysis of the situation in order to re-design the information on board of the buses. Aiming at identifying non homogeneous situations, a census of the information objects on board was carried out, in particular, checking which information were present and where they were located;
- research of new solutions in order to simplify the publishing and the handling of the timetables and other information on the web site;

- study of the kind of renewal to be brought to the timetable layout (booklet and leaflet) based on size, readability and multi-language (Russian, French, English,...) parameters;
- definition of the graphic aspect of the maps in order to make PT more desirable and reachable by potential users and in order to make the information about PT service easier to be detected all around the city.

### **B3 Situation before CIVITAS**

Brescia Trasporti consolidated constant care for travellers' needs recently led the company to pay more attention to the quality of the information about the public transport service provided to citizens.

Before CIVITAS, BST usually distributed bus timetables, booklets and leaflets at any seasonal change, but this activity needed an improvement, because of some identified problems concerning the readability, the fonts dimensions, the contents, the language, the target groups etc. of the existing info items.

Alongside this, in occasion of the Metrobus realization (its start up is foreseen by 2013) many road works were opened all around the city. This fact brought also to the further necessity to disseminate a more well-timed and up to date information about the variations caused to the usual PT service.

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Survey, definition of methodology and measure concept** (from April 2009 to February 2010) – *This stage scheduled the research activities that led to the new communication campaigns concept. The adopted methodology for the selection of the actions to be undertaken were described in a specific document (Deliverable 04.01.02) and can be synthesized by an in-depth analysis of the results of the customer satisfaction survey that the Transport Company historically carries out among its users, paying particular attention to the info quality perceived by the users.*

*The selected actions mainly consisted in 3 activities: development of a new timetable layout (booklet, leaflets and web) and targeted info items; installation of glass showcases in every town district; re-design of information on buses.*

*The attention to the quality information provided to usual and potential PT users is one of the reasons that pushed BST to renew the leaflets/timetables. From the evaluation point of view, it's important to underline that BST aimed at increasing the level of the information (accessibility and up-grade) in order to promote public transport and to rationalize and improve the accessibility of the service for example through the translation of the booklets into Russian, French and English. Alongside this, specific leaflets addressed to 13 years old students were realized, in order to promote the Public Transport among young people.*

**Stage 2: Distribution of the new info items to citizens** (from August 2009 to April 2012) – *This stage consisted in actually implementing the activities designed during the RTD phase.*

*The effective distribution to the public of the new timetables/maps design was carried out at any seasonal change. The image below (Fig. 6) shows the first new winter timetable leaflet produced in 2009, translated into English French and Russian.*



Fig. 6: New translated timetable booklet cover (winter period)

After the research activities that defined the target areas where glass showcases had to be installed or existing ones had to be equipped, a special agreement was taken with the company Clear Channel (which already deals with the advertising on bus shelters of Brescia Trasporti) in order to install new bus shelters (20 of its property) and to equip the existing ones (15) (Fig. 7).



Fig. 7: Glass showcases

As regards the activity related to the redesign of the information provided on board, the new developed stickers were the following:

- terms of travel (replaces the previous one);
- fares (replaces the previous one);
- sell of tickets on board (replaces the previous one. New version also in foreign languages as defined for timetables);
- strollers on board (new)

Besides the activities reported above, in summer 2011 the Brescia Mobilità SpA web site (which includes also the information about the PT service managed by BST) was upgraded ([www.bresciamobilita.it](http://www.bresciamobilita.it)), in order to improve the dissemination of information about PT (Fig. 8).

The website was conceived to clearly show in specific sections the most updated information about the timetables and the variations to the usual PT service. In particular on website, up to now, “Special timetables for Christmas 2011”, “Special timetables for Easter 2012” and “Special timetables for Winter 2012/2013” has been published.

It’s important to remark that the BST policy is to progressively substitute the targeted paper items with the information provided mainly through the new website, mainly because of economic and environmental reasons.

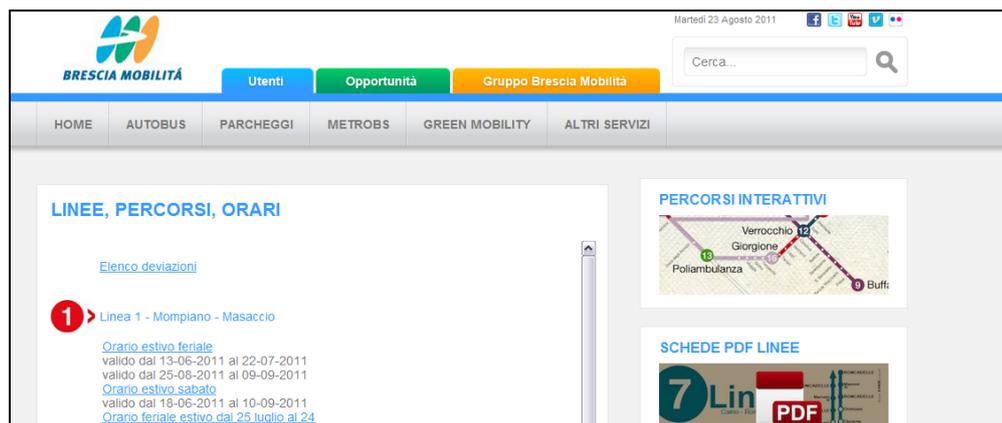


Fig. 8: Snapshot of the new BSM website showing the new seasonal timetables.

**Stage 3: Training for the drivers about the information campaign** (from January 2010 to February 2010) – This stage at the beginning scheduled specific training courses for the drivers, but due to organizational problems BST decided to train drivers and all the employees developing a specific newspaper item (on the company newsletter).

In occasion of the posting of new stickers on board, an official mail (with sample images) was sent to the communication and garage managers in order to inform employees on how to equip the buses with stickers and to inform drivers on how they could provide these news to passengers.

## B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure M04.03** – “Communication and educational campaigns”;
- **Measure M04.06** – “Mobility management actions”.

In fact, all these measures promote and spread the sustainable mobility policies, even through information campaigns.

It should be underlined that the indicators were set up in order to measure the impacts of the specific actions carried out in this measure, without bundling effect with the other measures mentioned above.

## C. Evaluation – methodology and results

The main objective of this measure was to spread information about PT service both generally speaking and in relation to targeted items, developed to reach kids attending different school years. Therefore, the measure was evaluated using the following set of indicators.

For some selected indicators, BST could count on a consolidated historical series of data deriving from the customer satisfaction survey which since many years the company carries out three times a year, confirming its interest to the quality of service perceived by the users. This survey foresees a standard set of questions including topics such as the overall users' satisfaction and environmental issues. In order to investigate some selected indicators, a specific questions have been introduced in the standard questionnaire. The introduction of this specific question was made twice during the period of the Civitas project in order to have an idea of the measure impact.

### C1 Measurement methodology

Indicators were divided into two macro-categories: “main” indicators and “complementary” indicators.

Main indicators were able to evaluate the measure efficiency in terms of objectives achievement; complementary indicators were introduced in order to assess specific issues and to better understand the measure performance at local level.

During the measure implementation some indicator was deleted because no more significant in the light of the measure evolution. This is the case of the indicator “Number of customer questionnaire filled in/Number of new customer questionnaires distributed” which was too much similar to indicator n.6 “Number of customer questionnaires filled in /Number of questionnaires distributed”.

Among the selected indicators, the majority was considered “main”, because they were strictly linked to the achievement of the targets at measure level (see paragraph A1). Only indicator n. 8 “Number of leaflets and booklets distributed/Total inhabitants of the area considered” was considered “complementary” because it was mainly interesting at local level.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators**

No.	Impact	Indicator	Data used	Comments
1	Service reliability	Quality of service	Customer Satisfaction interviews – BST Customer Satisfaction database	Main Indicator First data collection after OP: NOVEMBER 2009
2	Awareness	Awareness level	Customer Satisfaction interviews – specific question – BST Customer Satisfaction database	Main Indicator First data collection after OP: NOVEMBER 2009
3	Acceptance	Acceptance level	Customer Satisfaction	Main Indicator

No.	Impact	Indicator	Data used	Comments
			interviews – specific question – BST Customer Satisfaction database	First data collection after OP: NOVEMBER 2009
4	Society	Number of leaflets and booklets distributed/Total number of leaflets and booklets printed	BST database	Main Indicator First data collection after OP: WINTER (2009/2010)
5	Society	Number of glass showcases installed/Total of showcases planned	BST database	Main Indicator First data collection after OP: YEAR 2011
6	Society	Number of customer questionnaires filled in /Number of questionnaires distributed	BST Customer Satisfaction database	Main Indicator First data collection after OP: JULY 2010
7		<i>Number of customer questionnaire filled in/Number of new customer questionnaires distributed</i>	/	<b>DELETED:</b> because too much similar to indicator n. 6
7	Society	Number of targeted leaflets and booklets/Total student of 13 years old	BST database and Regione Lombardia database	Main Indicator First data collection after OP: YEAR 2008
8	Society	Number of leaflets and booklets distributed/Total inhabitants of the area considered	BST database and Istat database.	Complementary indicator First data collection after OP: WINTER (2009/2010)

## Detailed description of the indicators methodologies:

- Indicator 1 (QUALITY OF SERVICE)** - Quality of service is usually measured by means of customer satisfaction survey periodically carried out by Brescia Trasporti: this survey is composed of questions related to eight customer satisfaction indicators and of a concise indicator which resume the overall quality of service. Interviewed people express a judgement giving a mark from 1 (very unsatisfied) to 10 (very satisfied) answering the following questions: 1 – time spent for reach the destination; 2 – buses' punctuality; 3 – availability of tickets; 4 – safety about thefts and pick pocketing; 5 – buses' internal cleanliness; 6 – drivers' helpfulness and courtesy; 7 – information about timetables and routes; 8 – Brescia Trasporti attention for reduction of pollution. The sample size is of 1200 people, the survey is repeated 3 times a year (April, July and November) and is carried out to Brescia Trasporti customers: 700 face to face and 500 by phone. The sample is drowned in two different ways: for face to face interview at the bus stops

the place are identified on the basis of the lines, the end of the line or specific parts of lines; for the interview by phone there is a random sample from Omnibus Card database (subscribers) on the basis of the ticket used.

The 8 questions included in the standard customer satisfaction survey are the following:

1. Time spent to reach the destination (*Tempo impiegato per raggiungere la destinazione*);
2. Busses' Punctuality (*Puntualità dei mezzi*);
3. Availability of tickets (*Reperibilità dei titoli di viaggio*);
4. Safety about thefts and pickpocketing (*Sicurezza contro furti e borseggi*);
5. Busses' internal cleanliness (*Pulizia interna dei mezzi*);
6. Drivers' helpfulness and courtesy (*Disponibilità e cortesia degli autisti*);
7. Information about timetables and routes (*informazioni su orari e percorsi*);
8. Brescia Trasporti attention for reduction of pollution (*Attenzione di Brescia Trasporti per la riduzione dell'inquinamento*).

Among these question, the n. 7 expresses this indicator.

- **Indicator 2 (AWARENESS LEVEL)** - Awareness level of the initiatives was measured during the customer satisfaction surveys (described for the indicator n.1) introducing a specific question about the restyling of the timetables.
- **Indicator 3 (ACCEPTANCE LEVEL)** - Acceptance level of the initiatives was measured during customer satisfaction surveys (described for the indicator n.1) introducing a specific question about the restyling of the timetables.
- **Indicator 4 (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED/TOTAL NUMBER OF LEAFLETS AND BOOKLETS PRINTED)** - Data were collected at the end of every seasonal validity of timetables (in June of the following year after the printing for winter timetables and September for summer timetables). Undistributed stock of booklets/timetables were counted (included re-printing) in order to determine the exact number of undistributed items.
- **Indicator 5 (NUMBER OF GLASS SHOWCASES INSTALLED/TOTAL NUMBER OF SHOWCASES PLANNED)** - This indicator was the result of the comparison between the number of glass showcases installed and the planned one.
- **Indicator 6 (NUMBER OF QUESTIONNAIRES FILLED IN/NUMBER OF CUSTOMER QUESTIONNAIRES DISTRIBUTED)** - This indicator was measured using the results of the customer satisfaction surveys described in indicator n.1. As already said, the surveys consists of **1200** (700 face to face and 500 by phone) interviews repeated 3 times a year (April, July and November) and are carried out by conductors of surveys on Brescia Trasporti customers. For this reason there is no distribution of questionnaires and the success of the survey is determined in two steps as follows:
  1. Step one

- By phone: an interview is successful if the customer answers to the call; in case of no answer at the first call, 3 recall are carried out:
- Face to face: an interview is successful if the interviewed is a Brescia Trasporti customer; the location of the interview (at bus stop and on board) make easier the selection.

## 2. Step two

For both the kind of interviews a questionnaire is considered filled in and counted for the construction of the database if the interviewee answers to at least 6 indicator out of the 8 scheduled by the survey.

- **Indicator 7** (NUMBER OF TARGETED LEAFLETS AND BOOKLETS/TOTAL NUMBER OF STUDENT OF 13 YEARS OLD) - Data were collected by counting the number of targeted leaflets and booklets produced divided by the number of 13 years old students in Brescia.
- **Indicator 8** (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED/TOTAL NUMBER OF INHABITANTS OF THE AREA CONSIDERED) - Data were collected at the end of every seasonal validity of timetables (in June of the following year after the printing for winter timetables and September for summer timetables). Undistributed stock of booklets/timetables were counted (included re-printing) in order to determine the exact number of undistributed items. This data were divided by the total inhabitants of the area considered, composed by the city of Brescia plus the 14 neighbouring Municipalities covered by the LPT service.

## C1.2 Establishing a Baseline

BST is the transport company of Brescia and is part of the Brescia Mobilità Holding, whose main objective is to plan and manage, with an integrated approach, several activities concerning mobility, according to the municipal administration policies.

According to the company activities addressed to the improvement of the information accessibility, M04.01 scheduled mainly 3 activities:

1. restyling of the timetables and the realization of targeted info items;
2. installation of glass showcases and
3. information showed on board of buses.

The Baseline of the selected indicators for this measure was built mainly referring to the first 2 activities, which can be considered the most important ones, except for indicators 1 “Quality of service” and 6 “Number of customer questionnaire filled in/ Number of customer questionnaires distributed” which gave an overall perception of the quality of service and of the customer satisfaction survey questionnaire redemption.

It’s important to remark that the stage that led to the measure implementation was mainly the number 2 “Distribution of the new info items to citizens” which lasted from August 2009 to April 2012 (see section B4 “Actual implementation of the measure” for more details). Therefore, the baseline period was set before the beginning of that stage, namely summer 2009.

<b>Indicators related to the general perception of the quality of service/questionnaires redemption</b>	<b>BASELINE (Jul 2009)</b>
1) Quality of service (brief judgement of the information about timetables and routes)	7,07
6) Number of customer questionnaire filled in/Number of customer questionnaires distributed	0,73
Table 4 – Baseline for indicators 1 and 6	

The following indicators were selected to monitor the success of the booklet/leaflet restyling and of the targeted items.

For the indicators n.2 “Awareness level”, n.3 “Acceptance level”, n.4 “Number of leaflets and booklets distributed/total”, n.8 “Number of leaflets and booklets distributed/total inhabitants of the area considered” the baseline was generally referred to year 2009 because they were linked to the booklet restyling made before the release of the 2009/2010 winter timetables.

As regard indicator n.7 “N of targeted leaflets and booklets/total student of 13 years old”, linked to the targeted leaflets produced for the 13 years old students, the baseline was referred to year 2007, which is the situation before the beginning of Civitas.

<b>Indicators for the booklet restyling</b>	<b>BASELINE</b>
2) Awareness level (specific question - “level of awareness about restyling of timetable booklet”.)	Nov 2009 = 22,6%
3) Acceptance level (specific question – “level of acceptance about restyling of timetable booklet – considerations of the interviewed”)	Nov 2009 = 73,02%
4) Number of leaflets and booklets distributed/total number of leaflets and booklets printed	Summer timetable leaflets (2009) = 81,2%
7) Number of targeted leaflets and booklets/total student of 13 years old	1,74 (2007)
8) Number of leaflets and booklets distributed/total inhabitants of the area considered	Summer timetable leaflets (2009) = 40,6%
Table 2 – Baseline for indicators 2, 3, 4, 7 and 8	

As regard the installation of the glass showcases (evaluated through the indicator n.5 “Number of glass showcases installed/total number of showcases planned”), before CIVITAS the situation was represented by the values reported in the following table

Indicators for the glass showcases installation	BASELINE (2009)
5) Number of glass showcases installed/total number of showcases planned	3/14=0,21
Table 3 – Baseline for indicator 5	

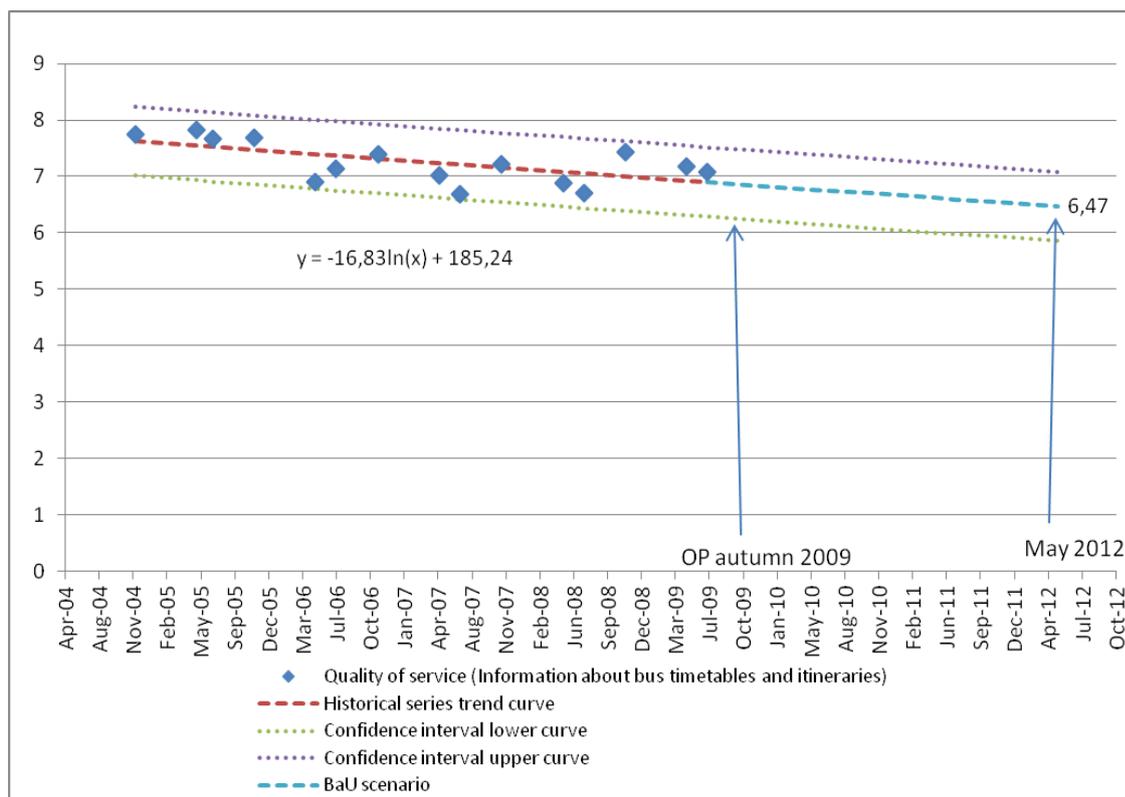
### C1.3 Building the Business-as-Usual scenario

As general methodological assumption for the BaU building, the time horizon was set in year 2012, before the start up of the Metrobus in Brescia (scheduled by 2013) and in occasion of the end of the Civitas project. After that year, probably, the activities concerning the mobility marketing of the transport company could significantly change.

Over the years Brescia Trasporti showed a great attention to its own customers. As a matter of fact, since 2004 the company has been carrying out periodical customer satisfaction surveys (which are administered 3 times a year face to face and by phone to 1200 users, who are interviewed on the quality of bus service). Brescia Trasporti policy was to invest many resources in improving the quality of the information provided to users, in particular redesigning timetables and itineraries and producing targeted info packs (for example school/university students).

As regards the indicator n.1 “Quality of service” (which is expressed by a brief judgement of the information about timetables and routes) it’s important to highlight that it was calculated using the results of the customer satisfaction survey mentioned above. During the standard survey, interviewees are usually asked to answer to 8 questions, giving a judgment going from 1 (very unsatisfied) to 10 (very satisfied). In particular, the questions concern the following topics: time spent to reach the destination; accuracy in time keeping; availability of tickets; safety about thefts and pickpocketing; buses internal cleanliness; drivers helpfulness and courtesy; information about timetables and routes; Brescia Trasporti attention for reduction of pollution.

The 8 marks are then synthesised into a unique value, expressing the overall quality of service provided by BST. Therefore, for the BaU building, a sufficient series of numeric historical data was available for a projection to the 2012 time horizon (see Graph 1). Table n.4 shows the BaU value obtained for May 2012. The BAU scenario has been built projecting the historical data series trend line (as shown in the following graph) starting from the operational phase (OP) date (autumn 2009):



**Fig. 8** Indicator 1 “Quality of service” expressed as a synthetically judgement during the Customer satisfaction survey carried out by Brescia Trasporti SpA. Projection of the historical data series in order to obtain the BaU scenario.

The BaU scenario for indicator n. 6 “Number of customer questionnaire filled in/Number of customer questionnaires distributed” (which expresses the standard customer satisfaction survey questionnaire redemption) could equal the Baseline value, because the procedure adopted for the customer satisfaction surveys didn’t significantly change in time.

Indicators for the general perception of the quality of service/questionnaires redemption	BaU (May 2012)
1) Quality of service (brief judgement of the information about timetables and routes)	6,47
6) Number of customer questionnaire filled in/Number of customer questionnaires distributed	0,73

Table 4 – BaU for the indicators related to the quality of service and questionnaires redemption

The participation to the CIVITAS project pushed BST in investing more resources in improving the level of information to citizens in terms of quality (restyling of booklets) and dissemination (number of leaflets distributed, targeted communication campaigns, etc.).

Without the Civitas contribution probably the timetable booklets wouldn't have been restyled, but only updated in occasion of the seasonal change of the bus timetables or itineraries.

As a consequence, indicators n.2 and 3 (related to level of awareness/acceptance towards the booklets restyling) had no BaU scenario; Indicator 4 "Number of leaflets and booklets distributed/total number of leaflets and booklets printed" could equal the average value of the 3 historical data available. As a matter of fact, this indicator expressed the capability of distributing the printed leaflets/booklets. There weren't sufficient historical data series about the undistributed stock, but it was possible to assess that this indicator likely wouldn't have changed without the Civitas contribution.

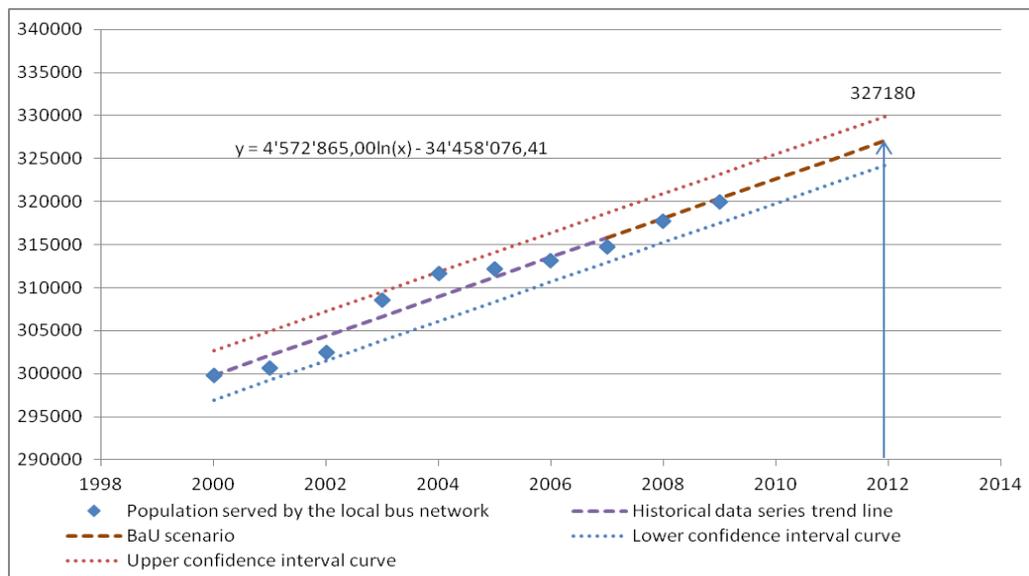
As regards indicator n.7 "Number of targeted leaflets and booklets/total number of student of 13 years old", its value was set to 0, assuming that likely without Civitas, targeted paper leaflets wouldn't have been physically printed, preferring other communication channels to disseminate the promotional initiative to targeted users (newspaper, website,...).

As regards indicator n.8 "Number of leaflets and booklets distributed/total number of inhabitants of the area considered", it was considered a "complementary" indicator. As a matter of fact the printing of the general timetable booklets was a consolidated activity. The number of printed booklets every year usually depends on the undistributed stock of the previous year and the bus passengers trend. Therefore, the BaU scenario for this indicator was built projecting the historical data series of the timetable printing and population.

Projection of the historical data series available for the distributed timetables leaflets/booklets:

<b>Year</b>	<b>Booklets and leaflets distributed</b>
Winter 2007/2008	145.000
Summer 2008	165.000
Winter 2008/2009	120.000
Summer 2009	130.000
↓	↓
BaU value (Summer 2012)	72.563
Table 5 Projection of the available historical data series about the number of distributed booklet/leaflet timetables	

Projection of the historical data series available for the population served by the local bus network:



**Fig. 9** Projection of the historical data series of the population served by the local bus network in order to obtain the BaU scenario for the indicator n.8 “Number of leaflets and booklets distributed/total number of inhabitants of the area considered”.

Indicators for the booklet restyling	BaU (2012)
2) Awareness level (specific question)	-
3) Acceptance level (specific question)	-
4) Number of leaflets and booklets distributed/total number of leaflets and booklets printed	86,5%
7) Number of targeted leaflets and booklets/total number of student of 13 years old	0
8) Number of leaflets and booklets distributed/total number of inhabitants of the area considered	(summer 2012) 22%

Table 6 – BaU for the indicators related to the booklets restyling

Moreover it’s important to underline that the use of other communication channels (i.e. website, newspapers...) could have influenced the number of printed and distributed leaflets and booklets, besides the undistributed stock of the previous year and the bus passengers trend. Therefore without Civitas the number of distributed leaflets and booklets would have been reasonably reduced, notwithstanding the increase of the area covered by the LPT service.

As regard the installation of the glass showcases (evaluated through the indicator n.5), the building of the BaU scenario was based on the consideration that probably without the Civitas contribution any new glass showcase would have been installed for lack of resources. Therefore, the BaU value for this indicator equalled the Baseline one.

Indicators for the glass showcases installation	BaU (2012)
5) Number of glass showcases installed/total number of showcases planned	3/14=0,21
Table 7 – BaU for the indicator 6 related to the glass showcases installation	

## C2 Measure results

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

### C2.1 Transport

**Table C2.1.1: Results obtained for the Indicators corresponding to area “Transport”**

Indicator	Before (July 2009)	After	B-a-U	Difference: After – Before	Difference: After – B-a-U
1) Quality of service (question n. 7 of the standard customer satisfaction survey “information about timetables and routes”)	July 2009: 7,07	Nov-09: 7,55	Nov-09: 6,85		
		May-10: 7,36	May-10: 6,77		
		Jul-10: 7,4	Jul-10: 6,75	Jul2010-Jul2009: +0,33	Jul2010-Jul2009: +0,65
		Nov-10: 7,44	Nov-10: 6,70		
		May-11: 7,46	May-11: 6,62	Jul2011-Jul2009: +0,07	Jul2011-Jul2009: +0,54
		Jul-11: 7,14	Jul-11: 6,60		
		Nov-11: 7,65	Nov-11: 6,55		

Concerning the trend registered for indicator 1 “quality of service” it was possible to say that the overall judgement expressed by the LPT users was positive. The BST interest towards a higher usability of the information led the transport company to re-think the quality of the information contained in the timetables in terms of readability and clarity, and this was one of the Civitas Work Package objective. Thanks to the surveys conducted during the Civitas period, the need of translating the timetables into different languages emerged, in order to better spread the information about the LPT among the foreign citizens and tourists moving in the city. The increasing value of the judgements about the information quality seemed to confirm the success of this initiative, especially just after the first release of the new item (winter season 2009/2010). As a matter of fact, the indicator passed from the value 7,07 registered in July 2009 before Civitas to 7,55 registered in November 2009.

### C2.2 Society

**Table C2.2.1: Results obtained for the Indicators corresponding to area “Society”**

Indicator	Before (variable)	After (variable)	B-a-U (May 2012)	Difference: After – Before	Difference: After – B-a-U
2) Awareness level (specific question)	Not ex ante foreseen	November 2009 = 22,6% July 2010 = 30,6%	Not assessable	Not assessable	Not assessable

Indicator	Before (variable)	After (variable)	B-a-U (May 2012)	Difference: After – Before	Difference: After – B-a-U
3) Acceptance level (specific question)	Not expected foreseen	November 2009 = 73,02% July 2010 = 70,10% May 2012= 7,2%	Not assessable	Not assessable	Not assessable
4) N of leaflets and booklets distributed/total	Summer 2009 = 81,2%	Winter timetable booklets (2009/2010) = 99,33 %	86,5%	+18,13	+12,83
		Winter timetable leaflets (2009/2010) = 99,13%	86,5%	+17,93	+12,63
		Winter timetable 2009/2010 (leaflets and booklets) = 99,23%	86,5%	+17,97	+12,67
		Summer timetable leaflets (2010) = 99,06%	86,5%	+17,86	+12,56
		Winter timetable booklet (2010/2011)= 94,92%	86,5%	+13,72	+08,42
		Winter timetable leaflets (2010/2011) = 96,86%	86,5%	+17,93	+10,36
		Winter integration leaflets 2010/2011= 91,58%	86,5%	+17,93	+05,08
		Winter timetable 2010/2011 (leaflets and booklets) = 94,45%	86,5%	+13,25	+13,25
		Summer timetable leaflets (2011) = 91,58%	86,5%	+10,38	+05,08
5) N of glass showcases installed/total of showcases planned	Year 2009 = 0,21	Year 2011= 2,5	Year 2011= 0,21	+2,29	+2,29
6) N of customer questionnaire filled in/ N of customer questionnaires distributed	2009 (July) = 0,73	2010 (July) = 0,71	2010 (July) = 0,73	-0,02	-0,02
		2011 (April) =0,73	Not Assessable	Not Assessable	Not Assessable
		2011 (Nov) =0,78	Not Assessable	Not Assessable	Not Assessable

Indicator	Before (variable)	After (variable)	B-a-U (May 2012)	Difference: After – Before	Difference: After – B-a-U
7) Number of targeted leaflets and booklets/Total student of 13 years old	2007: 1,74	2008: 0	2008: 0	-1,74	0
		2009: 0	2009: 0	-1,74	0
		2010: 0	2010: 0	-1,74	0
		2011: 5,17	2011: 0	+ 3,43	+ 5,17
8) N of leaflets and booklets distributed /total inhabitants of the area considered (%)	Summer 2009: 40,6%	winter 2009/2010: 46,2 %	winter 2009/2010: 37%	Not Assessable	Not Assessable
		summer 2010: 49,5%	summer 2010: 34%	+ 8,9%	+ 15,5%
		winter 2010/2011: 66,8 %	winter 2010/2011: 31 %	Not Assessable	Not Assessable
		summer 2011: 48,0%	summer 2011: 28,0%	+ 7,4%	Not Assessable
		winter 2011/2012: 52,35%	winter 2011/2012: 25%	Not Assessable	+20,0%

As regards the awareness and the acceptance level about the restyling of the timetables, expressed by indicators n. 2 and n. 3, the success of the initiative was generally confirmed (at least for the time being), probably because the restyling of the booklets is immediately well accepted by the users but in the course of time it isn't perceived as a noteworthy novelty.

The activity of distributing the information pack (indicator n.4 “N of leaflets and booklets distributed/total”) slightly increased going from 81,2% in summer 2009 to 97% in summer 2011, probably thanks to the Civitas contribution, which stimulated both the production and the distribution activities.

As regards the indicator n.5, which expressed the number of new showcases installed, the results were more positive beyond expectation, as thanks to Civitas (which represented a strong driver) an agreement with an advisory agency was signed, therefore the number of new installed glass showcases was higher than the originally planned one (in 2009 the number of showcases installed was 3 out of 14 planned showcases, while in 2011 they were 35 out of 14).

Indicators n. 6 “N of customer questionnaire filled in/ N of customer questionnaires distributed” registered a stable trend because the company in charge of administering the questionnaires had to reach a minimum number of interviewees.

The trend registered for the indicator n.7 “Number of targeted leaflets and booklets/Total student of 13 years old” showed that when targeted info packs were developed, their divulgation was successful. For the same reason, the distribution of the standard timetables and booklets respect to the population (indicator n.8), which was characterized by an up and down trend, seemed to increase probably thanks to a more widespread and capillary distribution.

Therefore, as final consideration, it's important to say the Brescia Transport Company always made a good dissemination of the information concerning the LPT service. Therefore the Civitas contribution mainly consisted in enhancing the way through which BST undertook these activities, allowing a better quantitative assessment of the target achievements.

### C3 Achievement of quantifiable targets and objectives

The following table shows the key objectives and numerical targets of the measure and the relative degree of achievement.

No.	Target	Rating
1	<p>Reach about the 80% of the students registered for the school year in progress, with targeted information about PT service, with particular attention to the student of 13 years old.</p> <p>This objective can be considered achieved in full.</p> <p><i>As a matter of fact, in order to verify the objective achievement, it's important to underline that a massive information distribution was done in 2011: the number of targeted leaflets and booklets distributed was higher than the number of kids attending the III classes in Brescia. In 2008, 2009, 2010 other communication channels were chosen (i.e. newspapers, website), then the number of distributed leaflets was 0. It's possible to consider that when leaflets and booklets were printed, these were fully distributed among kids. Then the objective was achieved.</i></p> <p><i>The specific indicator able to express numerically this achievement was the following:</i></p> <p><i>ind. 7 "Number of targeted leaflets and booklets/total student of 13 years old"</i></p> <p><i>Before (2007) = 1,74</i></p> <p><i>After (2011) = 5,17</i></p>	**
2	<p>Reach at least 30% of the citizens of the served area with the PT service information</p> <p><i>The achievement could be evaluated considering both the installation of glass showcases and the distribution of informational material and was exceeded.</i></p> <p><i>As regards the information at the bus stops through the installation of glass showcases, the initial number of showcases which had to be installed was 14. Then Brescia Trasporti decided to place new bus shelters with showcases integrated: these new ones were 20. Furthermore, 15 bus shelters were adapted to offer information at the bus stop.</i></p> <p><i>The indicators able to express numerically this achievement are the following:</i></p> <p><i>ind. 5 "N of glass showcases installed/total of showcases planned"</i></p> <p><i>Before (2009) = 3/14=0,21</i></p>	***

No.	Target	Rating
	<p><i>After (2011) = 35/14=2,5</i></p> <p><i>ind. 8 "Number of leaflets and booklets distributed / total inhabitants of the area considered"</i></p> <p><i>Before (Summer timetable leaflets in 2009) = 40,5%</i></p> <p><i>After (Summer timetable leaflets in 2011) = 47,5%</i></p>	
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b></p> <p><b>** = Achieved in full            *** = Exceeded</b></p>		

## C4 Up-scaling of results

For this Measure is not possible to predict an up-scaling of the results, as it is already dedicated to the whole population and to the area served by the LPT service.

## C5 Appraisal of evaluation approach

The indicators were selected to evaluate the achievement of measure objectives and they were divided into two different categories: "Transport" and "Society". For the first category, the indicator n.1 "Quality of service" was proposed in order to monitor the perception of the quality of the information provided to the population. This indicator was also useful to evaluate both the high level and strategic objective of the measure (to stimulate the use of PT in general).

The remaining indicators included in the category "Society" were useful to evaluate the measure level goal. In particular, indicators n.2 "Awareness level" and n.3 "Acceptance level" monitored the spread of information to specific target groups and their effectiveness as perceived by the population.

The evaluation approach originally described in the Evaluation Plan didn't vary significantly during the measure implementation.

## C6 Summary of evaluation results

The key results are the following:

- **Key result 1** – More than the 80% of the students attending the III class were reached by the targeted information campaign, exceeding the Measure objective;
- **Key result 2** – The goal to reach at least 30% of the citizens of the served area with the PT service information was achieved thanks to the installation of glass showcases at the bus stop (more showcases than the scheduled were installed) and a massive leaflets and booklets distribution to the inhabitants of the area served by Public Transport.

## **C7 Future activities relating to the measure**

The activities implemented in the measure will surely continue also after the end of the CIVITAS project, because they are a consolidated and effective way to spread out information and in particular BST will continue to:

- to keep the information provided to citizens up to date and easily accessible;
- to plan the future information campaign following the same approach used during Civitas, i.e. to detect a specific group of users and to realize targeted info items;
- to promote campaign about the new integrated PT service in occasion of the Metrobus star up in Brescia by 2013.

## D. Process Evaluation Findings

### D.0 Focused measure

This measure is not a focused measure.

### D1 Deviations from the original plan

The slight deviations from the original plan are the following:

- **Deviation 1 Translation of material produced in foreign languages** - the original plan consisted in restyling the timetables only from a graphic point of view. During the initial research activities it was decided to include also their translation into English, French and Russian, in order to make more accessible the information about the PT to the foreign population (both tourists and workers).
- **Deviation 2 Equipment of the existing one glass showcases** – in the measure description proposed in the DOW, initially only the installation of new showcases was scheduled, in order to post the bus timetables and the maps. During the measure implementation, thanks to an agreement with an advertising company, alongside the installation of new showcases, also some bus shelters have been renewed dedicating specific spaces for the bus timetables/maps. Thanks to this deviation, it was possible to equip a greater number of sites than the scheduled.

### D2 Barriers and drivers

In the following paragraphs we summarized, under key headings, some of the barriers and drivers experienced during the implementation of the measure.

#### D2.1 Barriers

Any significant barrier was experienced during the measure implementation, as this measure proceeded as scheduled in the project. The slight deviations from the original plan reported above had only positive impacts.

#### D2.2 Drivers

In the sequel main drivers, which were experienced during the measure implementation, are pointed out:

##### Preparation phase

- **Driver 1 – Facilitating cultural circumstances and life style patterns** Brescia Trasporti constant care for travellers' needs led the company to pay attention to the information dissemination about the public transport products

- **Driver 2 – Planning** A thorough user needs analysis and good understanding of user requirements helped BST in detecting the best solution for the information items restyling and targeting.
- **Driver 3 – Planning** The agreement with specialized advertising companies brought to the equipment of a greater number of sites (glass showcases and bus shelters) than the scheduled.

### **D2.3 Activities**

Any recovery action was undertaken as this measure proceeded as scheduled in the project. The slight deviations from the original plan reported above had only positive impacts.

## **D3 Participation**

### **D.3.1 Measure partners**

- **Brescia Trasporti s.p.a.** - the company, which manages the LPT in Brescia, is also in charge of disseminating the information items to the citizens.
- **Brescia Municipality** - some choices related to the LPT management (such as for example the bus shelters localization or renewal) and the BST strategic policies are agreed with the Municipality of Brescia.

### **D.3.2 Stakeholders**

In this measure stakeholders are represented by the citizens living in Brescia and in the neighbouring municipalities which are served by the LPT service. Their direct involvement was possible through periodic customer satisfaction surveys. Moreover, specific group of users (such as students or foreign people) were considered as target of specific information campaigns.

Another stakeholder for this measure was the advertisement company “Clear Channel” which manages the BST advertising items on board of the buses and at the bus shelters.

## **D4 Recommendations**

Basing on the lessons learnt from the implementation of the measure, the following recommendation can be drawn:

### **D.4.1 Recommendations: measure replication**

Any particular recommendation is given.

### **D.4.2 Recommendations: process**

- **Recommendation 1** – A thorough user needs analysis and the good understanding of user requirements can help in selecting the best solution for the information items design and dissemination.

- **Recommendation 2** – In order to grant a massive dissemination of the information related to LPT, the paper items (such as the printed timetables and booklets) cannot be completely substituted by communication channels characterized by high technological levels (such as the web sites or the smart phones).

## Annex 1: Historical data series for the BaU calculation

**Indicator 1 (QUALITY OF SERVICE)** - The quality of service in this case is expressed by the question n. 7 “**Information about timetables and routes**”. of the standard customer satisfaction survey.

Indicators	Nov-04	May-05	Jul-05	Nov-05	May-06	Jul-06	Nov-06	May-07	Jul-07	Nov-07	May-08	Jul-08	Nov-08	May-09	Jul-09
Time spent to reach the destination	6,31	6,47	6,71	6,25	6,43	6,52	6,55	6,47	6,72	6,84	7,25	6,78	7,2	7,08	7,26
Busses' Punctuality	6,06	5,94	5,89	5,49	5,36	5,96	6,41	6,1	6,84	6,63	6,87	6,58	7,15	6,71	6,76
Availability of tickets	7,76	7,67	7,18	7,54	8,01	8,1	8,48	8,48	8,11	8,19	7,45	7,4	8,04	7,79	8,1
Safety about thefts and pickpocketing	6,83	6,76	6,67	6,3	6,15	6,42	6,53	6,77	6,59	6,69	6,72	6,69	6,91	6,67	6,52
Busses' internal cleanliness	6,58	6,8	6,59	6,17	6,02	5,82	5,77	6,39	5,92	5,99	6,28	6,17	6,2	6,52	6,57
Drivers' helpfulness and courtesy	7,26	7,65	7,62	7,51	7,02	7,64	7,96	7,25	7,21	7,19	7,94	7,49	6,81	7,53	7,49
<b>Information about timetables and routes</b>	<b>7,75</b>	<b>7,83</b>	<b>7,67</b>	<b>7,68</b>	<b>6,91</b>	<b>7,13</b>	<b>7,39</b>	<b>7,02</b>	<b>6,68</b>	<b>7,21</b>	<b>6,88</b>	<b>6,7</b>	<b>7,44</b>	<b>7,17</b>	<b>7,07</b>
Brescia Trasporti attention for reduction of pollution	5,9	5,98	6,63	6,45	6,12	5,9	6,24	7,11	6,87	6,83	6,79	7,08	7,19	7,04	7,33
<b>Total Customer Satisfaction indicator</b>	<b>6,8</b>	<b>6,88</b>	<b>6,87</b>	<b>6,67</b>	<b>6,5</b>	<b>6,68</b>	<b>6,92</b>	<b>6,95</b>	<b>6,87</b>	<b>6,94</b>	<b>7,02</b>	<b>6,86</b>	<b>7,12</b>	<b>7,06</b>	<b>7,14</b>

### **Indicator 8 (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED/TOTAL INHABITANTS OF THE AREA CONSIDERED)**

The printing of the bus timetables is done twice a year at the beginning of summer and in autumn, in occasion of the seasonal timetable changes. This indicator is built making the ratio between the number of printed timetables and the population living in Brescia + the 14 municipalities served by the

bus network as specified in the public transport service contract. The data source for the population is the Istat database and is referred to the population living in the area on 31/12.

Historical data collection of the data concerns the distribution of booklets and leaflets in the year 2008/2009 as following:

	<b>Distributed</b>	<b>Inhabitants of the area</b>	<b>Distributed/ Inhabitants (%)</b>
Winter timetable booklets and leaflets 2007/2008 in 2007	145.000	314.737	46,0%
Summer timetable leaflets in 2008	165.000	317.694	51,9%
Winter timetable booklets and leaflets 2008/2009 in 2008	120.000	317.694	37,7 %
Summer timetable leaflets in 2009	130.000	319.994	40,6%

Population served by the local bus network, as established in service contract:

<b>City</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>
Borgosatol lo	7914	7986	8024	8106	8282	8455	8711	8851	9038	9160	9232
Botticino	9725	9735	9806	9924	10082	10237	10400	10480	10607	10700	10792
Bovezzo	7423	7420	7429	7464	7508	7480	7497	7466	7507	7558	7512
Brescia	187481	187188	187595	191114	192164	191059	190044	189742	190844	191618	193879
Caino	1576	1619	1696	1778	1835	1900	1948	2012	2033	2064	2082
Castel Mella	8043	8158	8478	8754	8928	9081	9430	10032	10338	10573	10803
Cellatica	4671	4733	4711	4757	4843	4849	4821	4862	4889	4942	4943
Collebeato	4357	4367	4426	4553	4679	4709	4747	4762	4758	4763	4771
Concesio	12772	12843	12933	13142	13304	13605	13865	14125	14501	14770	15005
Flero	7518	7496	7467	7570	7631	7806	7893	8145	8330	8375	8525
Gussago	14263	14529	14817	15324	15494	15704	16015	16175	16405	16585	16759
Nave	10321	10469	10575	10712	10798	10802	10860	10906	10952	11012	11142
Poncarale	4052	4143	4211	4413	4592	4860	5044	5143	5228	5272	5269
Rezzato	12226	12357	12547	12724	12851	12908	13076	13127	13143	13351	13429
Roncadelle	7459	7656	7811	8178	8611	8764	8835	8909	9121	9251	9369

Measure title:

# MOBILITY MARKETING IN BRESCIA

City: **Brescia**

Project: **MODERN**

Measure number: **04.01**

Total area served	299801	300699	302526	308513	311602	312219	313186	314737	317694	319994	323512
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## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1 (QUALITY OF SERVICE)** - This indicator and the related questions are measured with the same methodology since 2004. The quality of service in this case is expressed by the question n. 7 of the standard customer satisfaction survey “**Information about timetables and routes**”.

The **EX-ANTE SITUATION** is as following:

<b>Indicators</b>	<b>July-09</b>
Time spent to reach the destination	7,26
Busses' Punctuality	6,76
Availability of tickets	8,1
Safety about thefts and pickpocketing	6,52
Busses' internal cleanliness	6,57
Drivers' helpfulness and courtesy	7,49
<b>Information about timetables and routes</b>	<b>7,07</b>
Brescia Trasporti attention for reduction of pollution	7,33
<b>Total Customer Satisfaction indicator</b>	<b>7,14</b>

### AFTER SITUATION:

<b>Indicators</b>	<b>Nov-09</b>	<b>May-10</b>	<b>Jul-10</b>	<b>nov-10</b>	<b>mag-11</b>
Time spent to reach the destination	7,00	7,36	8,32	7,44	7,36
Busses' Punctuality	6,75	6,85	6,91	6,83	6,76
Availability of tickets	8,09	7,77	7,91	8,24	7,86
Safety about thefts and pick pocketing	6,17	6,28	6,42	6,3	6,8

Indicators	Nov-09	May-10	Jul-10	nov-10	mag-11
Busses' internal cleanliness	6,27	6,45	6,67	5,86	6,49
Drivers' helpfulness and courtesy	7,25	7,58	7,45	7,8	7,53
Information about timetables and routes	7,55	7,36	7,4	7,44	7,46
Brescia Trasporti attention for reduction of pollution	7,04	7,33	7,27	7,19	7,54
Total Customer Satisfaction indicator	7,01	7,12	7,17	7,14	7,22

- **Indicator 2 (AWARENESS LEVEL)** – The final indicator will take into account only the results of the specific question.

#### **AFTER DATA COLLECTION:**

It's important to highlight that the new timetables have been released in summer 2009 and the new specific question has been introduced in the **November 2009 survey**. In this period, as you can see from the results, about 70% of the interviewed people weren't aware of the new timetables issue. The good performance of the dissemination activities would be confirmed by the reduction of the percentage mentioned above.

#### **The specific questions introduced in the Nov09 survey is the following:**

- "level of awareness about restyling of timetable booklet".

The result is the "level of awareness about restyling of timetable booklet":

100% of the interviewed customer have answered to the specific question and are divided as following:

- 69,06% haven't seen the new booklet (a lot of customers 67,2% use other objects for collection of the information about PT service);
- 22,64% has the new booklet and have noticed differences with the previous one;
- 8,31% has the new booklet and haven't noticed differences with the previous one.

Indicator 2 = 22,64%

The result is the "level of awareness about restyling of timetable booklet"(specific question) referred to the **period 2010II** is:

100% of the interviewed customer have answered to the specific question and are divided as following:

- 65,80% haven't seen the new booklet (a lot of customers 67,2% use other objects for collection of the information about PT service);
- 30,60% has the new booklet and have noticed differences with the previous one;
- 3,60% has the new booklet and haven't noticed differences with the previous one.

Indicator 2 = 30,60%

**NOTICE: The specific question hasn't been collected many time because Brescia Trasporti preferred to deepen the topic of the increase of the tariff because it is considered a strategic issue for the company.**

- **Indicator 3 – (ACCEPTANCE LEVEL)** - The final indicator will take into account only the results of the specific question. This question has been introduced in order to investigate the acceptance level of the timetable booklet restyling (see indicator 2).

#### **AFTER DATA COLLECTION:**

It's important to highlight that the new timetables have been released in summer 2009 and the new specific question has been introduced in the **November 2009 survey**. In this period, as you can see from the results, about 70% of the interviewed people weren't aware of the new timetables issue. The good performance of the dissemination activities would be confirmed by the reduction of the percentage mentioned above.

#### **The specific questions introduced in the Nov09 survey is the following:**

- "level of acceptance about the restyling of timetable booklet – considerations of the interviewed".

The result is the "level of acceptance about restyling of timetable booklet – considerations of the interviewed":

22,6% of those have awareness of the restyling of the timetable booklet (see indicator 2) have considered as following:

- 69,42% clear, complete and good structured;
- 11,51% more complicated than the previous one;
- 7,19% orizontal readability of the timetable is more uncomfortable than the previous;
- 4,68 % fonts too small;
- 3,60% good apparence;
- 3,60% other negative considerations.

Indicator 3 is equal to the positive answers sum: "clear, complete and good structured" and "good apparence".

Indicator 3 = 69,42% + 3,60% = 73,02%

#### **July 2010 survey:**

In the customer satisfaction survey 2010 II the specific question was introduced concerning the acceptance level

As it was made for the previous survey

Indicator 3 = 70,10%

**May 2012 survey:**

In the customer satisfaction survey 2012 I the specific question was introduced concerning the acceptance level

As it was made for the previous surveys

Indicator 3 = 7,20%

- **Indicator 4 – (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED/TOTAL) -**

**EX ANTE SITUATION:**

Collection of the data for the ex ante situation concerns the printing of the booklets and leaflets in the year 2008/2009 as following:

		<b>Printed</b>	<b>Undistributed stock</b>	<b>Distributed</b>	<b>Distributed/printed (%)</b>
Ex ante	Winter timetable booklets (2008/2009)	30.000	0	30.000	100 %
Ex ante	Winter timetable leaflets (2008/2009)	115.000	25.000	90.000	78,3%
Ex ante	Summer timetable leaflets (2009)	160.000	30.000	130.000	81,2%

**AFTER DATA COLLECTION:**

Collection of the data for the in on going situation concerns the printing of the booklets and leaflets in the year 2009/2010 and 2010/2011 as following:

		<b>Printed</b>	<b>Undistributed stock</b>	<b>Distributed</b>	<b>Distributed/printed (%)</b>
Ongoing Measurement	Winter timetable booklets	30.000	200	29.800	99,33%

		Printed	Undistributed stock	Distributed	Distributed/printed (%)
	(2009/2010)				
Ongoing Measurement	Winter timetable leaflets (2009/2010)	115.000	1.000	114.000	99,13%
Ongoing Measurement	Summer timetable leaflets (2010)	160.000	1.500	158.500	99,06%
Ongoing Measurement	Winter timetable booklets (2010/2011)	29.560	1.500	28.060	94,92%
Ongoing Measurement	Winter timetable leaflets (2010/2011)	175.000	5.500	169.500	96,86%
Ongoing Measurement	Winter timetable integration booklets (2011)	20.200	1.700	18.500	91,58%
Ongoing Measurement	Summer timetable leaflets (2011)	20.200	1.700	18.500	91,58%

• **Indicator 5 (NUMBER OF GLASS SHOWCASES INSTALLED/TOTAL OF SHOWCASES PLANNED)**

The number of installed glass showcases is 3 that will be object of upgrade and restyling (Central hospital, Train Station, Via F.lli Ugoni). The total number of planned new showcases is 11 and are mentioned as below:

- ✓ Casazza – S. Bartolomeo;
- ✓ Pendolina – Urago Mella;
- ✓ Q.re Abba – Torricella;
- ✓ Mandolossa – Villaggio Badia;
- ✓ Villaggio Violino;
- ✓ Primo Maggio – Don Bosco;

- ✓ Girelli – Noce (not residential districts);
- ✓ Villaggio Sereno – Fornaci;
- ✓ Folzano;
- ✓ Sanpolino – S. Polo;
- ✓ S. Polo Case – Buffalora.

The installation of the new showglasses depends on the authorization of Brescia Trasporti Boards of Directors (Consiglio Di Amministrazione).

Actually there is a great level of satisfaction of the information on PT and attention will be focalized on upgrading of the existing ones by means of the up grade of the posters in bus shelters (maps, list of routes and other necessary information).

Therefore, the indicator results is:

Total number of planned showcases: 14

Total number of installed showcases: 3

**Indicator 5 =  $3/14 = 0,21$**

#### **AFTER DATA COLLECTION (Summer 2011)**

Instead of installing new showcases, BST has reached an agreement with the Company Clear Channel, which has allows to install new bus shelters, specifically structured to accommodate space for hours, and the requalification of some existing ones.

The current situation is therefore as follows:

Total number of planned showcases: 14

Total number of new installed bus shelters: 20

Total number of requalified bus shelters: 15

**Indicator 5 =  $35/14 = 2,5$**

- **Indicator 6 – (NUMBER OF QUESTIONNAIRES FILLED IN/NUMBER OF CUSTOMER QUESTIONNAIRES DISTRIBUTED)** - This indicator is measured by the results of customer satisfaction surveys filled in.

#### **EX-ANTE SITUATION:**

The ex ante of this indicator is referred to SUMMA historical statistics: the number of interviews that must be done to reach the 1200 sample size (filled in questionnaires) is **1650**: given by 900 (face to face) and 750 (by phone).

Therefore ex ante data is the following:

*Number of filled in questionnaires = 1200*

*Number of customer questionnaires distributed = 1650*

***Indicator n.6 = 1200/1650 = 0,73***

For the other surveys, SUMMA has provided the actual number of contacts so that it is possible to have a performance trend for this indicator. The adopted methodology consists in calculating the so called questionnaires “redemption”. This indicator is composed by two contributions: the first one coming from data related to the face to face interviews and the second one from the phone interviews (the sample size is extracted from the omnibus card owner list).

In detail the “redemption” formula is the following:

$$\text{Indicator 6} = \frac{ie_f + ie_t}{ie_f + rif_f + ie_t + rif_t}$$

Where:

$ie_f$  = number of complete face-to-face interviews;

$rif_f$  = number of denies

$ie_t$  = number of complete phone interviews;

$rif_t$  = number of denies and number of failed phone calls (after the third try)

so that the single contributions can be calculated this way:

$$\text{Face - to - face _ redemption} = \frac{ie_f}{ie_f + rif_f}$$

and

$$\text{Phone _ redemption} = \frac{ie_t}{ie_t + rif_t}$$

#### **AFTER DATA COLLECTION (July 2010):**

*Number of filled in questionnaires = 1210*

*Number of customer questionnaires distributed = 1706*

***Indicator n.6 = 1210/1706 = 0,71***

#### **AFTER DATA COLLECTION (April 2011):**

*Number of filled in questionnaires = 1210*

*Number of customer questionnaires distributed = 1666*

***Indicator n.6 = 1210/1666 = 0,73***

**AFTER DATA COLLECTION (November 2011):**

*Number of filled in questionnaires = 1242*

*Number of customer questionnaires distributed = 1586*

***Indicator n.6 = 1210/1706 = 0,78***

- **Indicator 7 (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED AT SCHOOL/TOTAL STUDENT OF 13 YEARS OLD)**

The Transport company produced targeted info packs (leaflet) to be disseminated among the students attending the III year at middle school. The goal is to inform them about the promotional activities concerning the public transport in the view of their future travels to reach the secondary school.

In order to evaluate this dissemination activity, the selected indicator consists in the ratio between the number of targeted leaflet distributed at the end of the school year and the number of students attending that school year. As regard the n. of targeted leaflets the source is the transport company; as regard the number of 13 years old students the source is the Regione Lombardia database.

**EX ANTE SITUATION (UP TO 2007)**

2006: printed 3000 leaflet for the III middle school year students; left at the infopoints in June 2006 as free promotional material addressed to the students at the end of the school year 2005/2006. Students = 1663

2007: printed 10000 unique leaflet for the promotional initiatives addressed to II media e V superiore; distributed to III media students are anyway 3000. Students A.A. 2006/2007 = 1722

	<b>2006</b>	<b>School year 2005/2006</b>	<b>2007</b>	<b>School year 2006/2007</b>
Number of printed targeted leaflets and booklets	3.000		3.000	
Total student of 13 years old		1663		1.722
Indicator 7	1,8		1,74	

**AFTER THE BEGINNING OF CIVITAS:**

2008, 2009 and 2010 any targeted paper leaflet has been printed but the information have been disseminated through other channels (newspapers, website, etc).

Indicator 7 (2008, 2009, 2010) = 0

2011: printed 10000 leaflet for the III middle school year students. So many leaflets because disseminated directly to each school. Distributed to students attending the school year 2010/2011 (students = 1931)

	<b>2011</b>	<b>School year 2010/2011</b>
Number of printed targeted leaflets and booklets	10.000	
Total student of 13 years old (III class of junior high school) from the Lombardia Region database		1.931
Indicator 7	5,17	

2012: any targeted paper leaflet has been printed but the information have been disseminated through other channels (newspapers, website, etc). A massive campaign will be organized to promote the new Metro line (start up foreseen at the beginning of 2013) and its integration with other mobility forms, so no specific leaflet has been printed.

- **Indicator 8 (NUMBER OF LEAFLETS AND BOOKLETS DISTRIBUTED/TOTAL INHABITANTS OF THE AREA CONSIDERED)**

The printing of the bus timetables is done twice a year at the beginning of summer and in autumn, in occasion of the seasonal timetable changes. This indicator is built making the ratio between the number of printed timetables and the population living in Brescia + the 14 municipalities served by the bus network as specified in the public transport service contract. The data source for the population is the Istat database and is referred to the population living in the area on 31/12.

#### **EX ANTE SITUATION:**

Collection of the data for the ex ante situation concerns the distribution of booklets and leaflets in the year 2008/2009 as following:

	<b>Printed</b>	<b>Inhabitants of the area</b>	<b>Distributed/ Inhabitants (%)</b>
Winter timetable booklets and leaflets 2007/2008 in 2007	145.000	314.737	46,0%
Summer timetable leaflets in 2008	165.000	317.694	51,9%
Winter timetable booklets and leaflets 2008/2009 in 2008	120.000	317.694	37,7 %
Summer timetable leaflets in 2009	130.000	319.994	40,6%

**AFTER DATA COLLECTION:**

After the new timetable restyling since the autumn 2009, the collected indicator is characterized by the following values:

	<b>Printed</b>	<b>Inhabitants of the area</b>	<b>Distributed/ inhabitants (%)</b>
Winter timetable booklets and leaflets (2009/2010) in 2009	145.000	319.994	46,2%
Summer timetable leaflets in 2010	160.000	323.512	49,5%
Winter timetable booklets and leaflets (2010/2011) in 2010	216.060	323.512	66,8%
Summer timetable leaflets in 2011	155.200	323.141	48,0%
Winter timetable booklets and leaflets (2011/2012)	171.000	326.631	52,35%

*Measure title:*      **COMMUNICATION AND EDUCATIONAL CAMPAIGNS IN BRESCIA**

*City:*      **Brescia**

*Project:*      **MODERN**

*Measure number:*      **04.03**

## **M04.03 – Executive summary**

The constant care of the society which manages the LPT service in Brescia (Brescia Trasporti) for sustainable mobility led them to plan the dissemination of the sustainable mobility culture. Brescia Trasporti has then supported Brescia Municipality during the European sustainable mobility weeks (organised every September) and has involved the primary schools in days about sustainable mobility.

Brescia Trasporti distributed to youngest citizens informative material about sustainable mobility, such as a leaflet called “10 good reasons to take the bus”. Thanks to the Civitas Initiative the promotion of the following actions has been possible:

- "EDU" project in primary schools. The objective of this educational programme was to explain to the primary school students the importance of the environmental sustainability, civic perception, security, social and health - promoting also the importance of public transport use - trough educational lessons and interactive activities;
- "Running Words" project. The objective was to involve LPT bus passengers through a national project which foresaw a local contest addressed to non-professional writers. Passengers of LPT participated to the contest writing short stories during their trips by bus, to highlight the emotional experience while travelling and the winner of the local contest was invited to the national competition.
- "European Sustainable Mobility Week", this event, which takes place every year in September, was used to inform citizens on Brescia mobility choices such as sustainable mobility actions and projects promoted by the Municipality of Brescia, Brescia Trasporti and Brescia Mobilità.

As a measure result the number of students attending the “EDU project”, with respect to the number of students attending the 3rd and 4th classes at the primary schools, increased from 23% (school year 2007/2008 before Civitas) to 35% (school year 2011/2012). Additionally, the promotion of the national project “Running words” was improved. A tangible outcome has been the significant increase of the interest for “Running words” project: the number of participants doubled (from 11 published tales in 2009 to 23 in 2011), despite the national trend (in 2010 the number of tales published at national level decreased by 30% respect to the 2009 edition).

A great effort was made in promoting the editions of the actions mentioned above. The collaboration among partners and all the involved providers has been fundamental for the measure success. The direct involvement of stakeholders, also through targeted dissemination campaigns, has been crucial to spread the information throughout the city.

*Measure title:* **COMMUNICATION AND EDUCATIONAL CAMPAIGNS IN BRESCIA**

*City:* **Brescia**

*Project:* **MODERN**

*Measure number:* **04.03**

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(S) High level / longer term:

- To stimulate people to use public transport and to promote PT service.

(T) Strategic level:

- To increase the level of information about PT (accessibility and up-grade) in order to promote public transport and to rationalize and improve the accessibility of the service.

(U) Measure level:

- (1). To promote the national project EDU in order to involve about 30% of the students of 3rd and 4th classes registered for the school year in progress;
- (2). to promote the national project "Running words";
- (3). to organize and support the European Sustainable Mobility Week (for each year) and consider its success in relation with the participation of the citizens to some initiatives.
- (4). to involve, through the described initiatives, citizens (about 50.000 each year), students (about 1.000 each year) and media (about 5 pages on the local media for each year).

### **A2 Description**

Brescia Trasporti (BST), which manages the LPT service in Brescia, traditionally gives particular attention towards the sustainable mobility topic, also through the promotion of specific activities addressed to targeted groups of users.

The measure consisted mainly of three activities, which aimed to spread out as much as possible sustainable mobility culture among citizens increasing social awareness on the topics mentioned below.

The first activity consisted in the participation to the national project EDU. The EDU project foresees a series of thematic lessons for a maximum of 70 classes addressed to kids aged between 8 and 10. At the beginning of every school year students took part to these lessons, which deal with public transport and safety related issues. Kids attending 3<sup>rd</sup> classes are usually involved in specific activities, such as education, training, play in groups, etc. Kids attending 4<sup>th</sup> classes are usually involved in lessons which are carried out on bus in order to teach them the correct behaviours on board.

The second activity was the participation to the national project "Running Words", a cultural project conceived to spread out the sustainable mobility culture. In this project PT travellers write a

Measure title: **COMMUNICATION AND EDUCATIONAL CAMPAIGNS IN BRESCIA**

City: **Brescia** Project: **MODERN** Measure number: **04.03**

novel/short tale that can be read during a PT trip. The objective is to remind people that the PT modal choice actually helps the development of a smart city.

The third activity consisted in the participation to the "European Mobility Week", which takes place every year in September. This event is considered fundamental for Brescia. As a matter of fact, every year, during this week, many activities are organized, involving citizens, in order to spread sustainable mobility culture and to give value to alternative “sweet” mobility modes improving safety and liveability for their users. During Civitas, seminars, conferences, several performances and events were yearly organized (see Fig. 1 which shows the 2012 edition program); at the same time, info points about sustainable mobility actions in Brescia were located.



Fig.1: European Mobility Week 2012 program

## **B. Measure implementation**

### **B1 Innovative aspects**

The innovative aspects of the measure are:

- **Targeting specific user groups** – The initiatives were addressed to specific groups of users: disseminating the culture of sustainable mobility among Brescia citizens, starting from the new generations, gives a very strong contribution in helping the Municipality to implement a long term strategic framework on sustainable mobility and change the travelling modal choices. Therefore, Brescia Trasporti organized a heterogeneous set of activities addressed to the youngest people (i.e. the EDU project or the distribution of leaflet about sustainable mobility, such as the “10 reasons to take the bus” leaflet), to bus passengers (the Running Words project), and to all the city users (the organization of the European Mobility Week in collaboration with the Municipality of Brescia).
- **New organisational arrangements or relationships** – The innovative contribution of the measure consisted of an integrated and organic vision of the initiatives also within the activities promoted by the City Council.

### **B2 Research and Technology Development**

This measure didn't foresee relevant RTD activities.

The three main DEMO activities are better detailed in the following section, in particular in the section B4 “Actual implementation of the measure”.

### **B3 Situation before CIVITAS**

The attention towards the issue of sustainable mobility is traditionally part of the BST's strategy: as a matter of fact, for years, BST promoted specific activities addressed to particular types of users.

Civitas support allowed BST to invest a greater effort in the education of citizens on sustainable mobility.

“EDU project” was born in 2007 to promote PT in youth people. The idea at the basis of the project implementation was to teach kids that using sustainable means of transport is both a healthy way to move and a living style. As everybody know, talking to children means spreading the message also among other citizens “categories”, such as parents or grandparents, which are induced to reflect about sustainable mobility, being involved in their children/nephews' education.

As a matter of fact, higher investments, available thanks to Civitas project, allowed BST to maintain continuity in offering educational campaigns addressed to the new generations. The implementation of the educational campaigns during CIVITAS Project allowed also to make citizens aware that BST develops and carries out projects for the future of the city.

The participation to the national project EDU usually consists in arranging thematic lessons for a maximum of 70 classes composed by kids aged from 8 to 10. The topics faced during the lessons concern public transport, safety, socialization, civil responsibility, health.

Also the national project "Running Words" is a cultural project developed at national level to spread out the sustainable mobility culture. The first edition of the project dates back to 2002 and involved citizens using PT. In this project PT travellers write a novel or a short tale that can be read during a PT trip. The objective is to involve people and remind them that the PT modal choice could help the development of a smart city.

These first two projects are relatively not well consolidated in Brescia, as a matter of fact the editions are not constant in time. CIVITAS strongly contributed in keeping and systematizing such activities.

As regards the EU mobility week, Brescia attended to this campaign since 1999. A great attention was given to organize this event from 1999 to 2007; the goal was to follow the "all criteria of the European Charter", focusing on the theme chosen for the year by UE.

The European Sustainable Mobility Week can be considered a quite consolidated activity in Brescia, but CIVITAS contributed to maintain the commitments in organizing the events notwithstanding the risk of abandonment potentially offered by the political alternation in the city administration occurred in 2008, the year of the beginning of the Civitas Project.

## **B4 Actual implementation of the measure**

The measure was articulated in one main stage (from the beginning to the end of the project) including all the necessary activities addressed to the organization of the three annual initiatives: "EDU Project", "Running Words" and the European "Sustainable Mobility Week".

Besides the arrangement of the events, the preparatory activities were annual and were carried out monitoring the success of the past events and developing the recovery plan that could be needed in case of failure.

The measure was implemented as follows:

**Stage 1: Annual participation to the three projects (March 2009 – June 2012)** – *At the beginning of each school year, students aged between 8 and 10 joined the EDU Project. During the scheduled events, specifically designed educational material was distributed (comics brochures, Interactive CD-ROMs, Timetable booklets, PT maps, Promotional leaflets on special fares, subscription forms, etc, as shown in figures 2, 3 and 4) and conditions were set to organize the second step of the project for the next school year. A consolidate timetable was followed every year. In particular, during the school year 2008/2009:*

- *In April 2009 lessons on board of busses for the 22 involved classes with distribution to the kids of leaflets with targeted information on PT and projection of a video (2 and 8 minutes).*
- *In June 2009: official mailing to the School District Headmaster to inform teachers about the new edition of the initiative for the next school year 2009/2010.*
- *Collection of the participation of the teachers and their classes.*
- *Collaboration with the company Galleria della Natura, specialized in involving young people in educational initiatives, to increase the number of schools participating in the project.*



Fig.2: On the left, promotional leaflets on special fares, on the right Interactive CD ROM on EDU Project

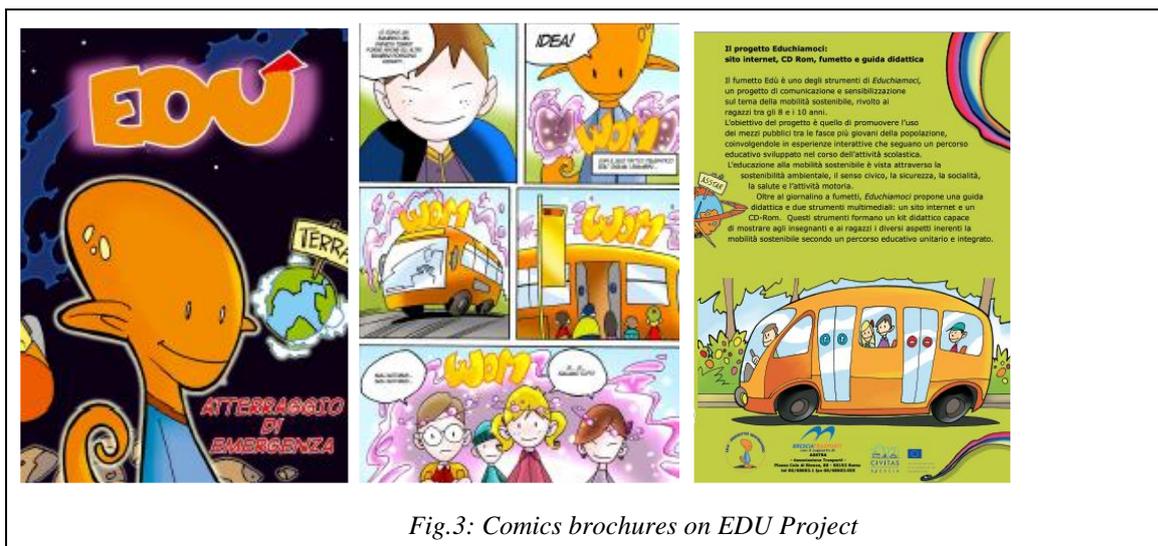


Fig.3: Comics brochures on EDU Project

The same activities were implemented during the school years 2009/2010, 2010/2011 and 2011/2012.

The 2011/2012 edition offered also a site visit to a metro stop under construction, in order to disseminate information about the new metro system, a new PT way of travel that the citizens of Brescia may use in 2013 when the start up is scheduled. (after CIVITAS). This was done in co-operation with the teachers which had to accompany kids during the visit.

Teachers were recalled to check their availability and to organize either the visit to the metro stop under construction or the trip on board of busses.

A preliminary training session in a metro stop with BSM technicians and the "Galleria della Natura" operators had been scheduled before the visit: one or two operator of "Galleria della Natura"

participated with the students to the trip in order to reach a strong coordination to EDU contents project and the lessons already done in the classes.

At the end of the visit, an information pack and gadgets were given to each student so that they could bring it to their parents and become dissemination "instruments" within their families.



Fig.4: Newspaper item on Giornale di Brescia 2nd November 2011

The participation to the yearly edition of the national project "Running words" was prepared through the following activities:

- in May, the final design of the communication campaign and press conference were arranged to launch the contest (as shown in figure 5);
- the participants to previous editions were mailed;
- a specific page about the contest on Brescia Trasporti web site was developed;
- in August the contest had its official end;

- *evaluation of the novels/short tales: the panel was composed of employees of Brescia Trasporti who evaluated the nameless composition; only after the redaction of every judge's ranking the name of the authors of the winners was revealed to the jury;*
- *award ceremony of the finalists (as shown in figures 6 and 7) and publication of the novels in a collection edited by ASSTRA (which is the national Transports Association, that includes the LPT companies in Italy; it collects the data related to the PT activities at local and nation level), which was put on sale in bookstores (as illustrated in figure 8).*

**Parole in corsa.**  
Hai carta bianca, mettilci la penna  
edizione 2010

Scrivi un racconto a tema libero ed invialo entro e non oltre l'8 settembre 2010 unitamente ai tuoi dati (vedi regolamento) e all'autorizzazione alla pubblicazione, a:  
paroleincorsa@bresciastrasporti-spa.it  
oppure su floppy disc o CD-ROM a

Ufficio Marketing e Comunicazione presso  
Brescia Trasporti Spa  
Via San Donino, 30  
25128 Brescia

Un'apposita giuria valuterà gli scritti e selezionerà il vincitore, nonché gli altri 4 finalisti. Il primo classificato riceverà in premio:  
- un WEEKEND per due persone in occasione della premiazione del vincitore del concorso nazionale a cui parteciperà di diritto;  
- due abbonamenti annuali su tutta la rete di Brescia Trasporti

Gli altri premi sono specificati sul regolamento.

Tutti i racconti saranno pubblicati su questo sito al termine del concorso.  
Scarica la LOCANDINA (pdf)  
Scarica il REGOLAMENTO (pdf)  
Scarica l'AUTORIZZAZIONE ALLA PUBBLICAZIONE (pdf)  
Scarica l'AUTORIZZAZIONE ALLA PUBBLICAZIONE PER I MINORI (pdf)

Siti di interesse:  
www.asstra.it  
www.fulcoloursound.it

Del spazio alla fantasia a scriver un racconto. Anche quest'anno il tema è libero.

Invia il tuo racconto entro l'8 settembre 2010 a paroleincorsa@bresciastrasporti-spa.it oppure su floppy disc o cd-rom a Brescia Trasporti, Via S. Donino 30, ufficio Marketing.

Il primo classificato riceverà un week end per il proprio nella città dove avverrà la premiazione.

I abbonamenti annuali alla rete Brescia Trasporti si intenderanno al concorso nazionale.

Info e regolamento su: www.bresciastrasporti-spa.it

Il tuo racconto viaggia con noi

Fig.5: Web page promoting the 2010 edition of the project Running Words

**BRESCIA OGGI**  
Venerdì 30 Ottobre 2009

**Cronaca 9**

**IL CONCORSO LETTERARIO.** Premiate in cinque da Brescia Trasporti

**«Parole in corsa», sui bus viaggia anche la letteratura**

Per dare spazio alla fantasia di chi ogni giorno sale e scende dagli autobus cittadini, Brescia Trasporti ha indetto il concorso letterario «Parole in Corsa». I cittadini sono stati invitati ad elaborare una short story a tema libero e i racconti pervenuti sono stati giudicati da una commissione interna che, ieri, ha premiato i cinque racconti giudicati più meritevoli. Il primo vincitore bresciano avrà la possibilità di partecipare alla selezione nazionale in programma per gennaio 2010. «Si tratta della seconda edizione del concorso e siamo felici che la maggior parte dei racconti sia stata scritta da giovani studenti universitari che ogni giorno si muovono grazie ai trasporti pubblici della città», ha spiegato il presidente

Andrea Gervasi. Per il quinto e il quarto premio, rispettivamente assegnati alla ventitreenne Benedetta Sabri con le sue «Sfumature di viaggio» e alla sedicenne Cinzia Perini con «Un sempre nel mai», Brescia Trasporti ha regalato due abbonamenti semestrali per l'intera linea di trasporti urbani. La medaglia di bronzo è andata alla diciannovenne Chia-

ra Co, autrice del racconto «Senza Colpa» e vincitrice di un abbonamento annuale del valore di 250 euro, mentre il secondo premio è stato assegnato a Beatrice Flocchini e al suo «Sogno» aggiudicandosi due abbonamenti annuali alla rete di Brescia Trasporti. Sul gradino più alto del podio è salita invece Grazia Abbaticchio con la short story «L'amore mio non aspetta che spunti la luna», vincitrice di un week end nella città delle premiazioni nazionali e di due abbonamenti annuali agli autobus cittadini. Tutti i racconti premiati entreranno in una pubblicazione. **F. BEN.**

Foto di gruppo per le vincitrici del concorso con il presidente Andrea Gervasi e Claudio Garatti F. OTTOLEVI

Fig.6: Newspaper item of the award to the project Running Word contest 2009



Fig.7: Newspaper item of the award to the project Running Word contest 2010



Fig.8: Publication on AQuattro – Brescia Mobilità magazine

*“European Sustainable Mobility Week” has been organized in Brescia since 1999.*

*In year 2009-2010-2011 (as usual) the Municipality of Brescia was the main promoter of the initiatives related to the “European Sustainable Mobility Week”*

*During Civitas, as usual, Brescia Trasporti supported the organization and promotion of the following initiatives:*

- *communication campaigns (press items on initiatives of the project were reported has shown in figure. 9);*
- *meetings with authorities to organize the events of the week;*
- *"in town without my car day", in accordance with the Mobility Manager of University of Brescia, during which Brescia Trasporti provided dedicated free tickets (as in figure 10) for the employees (working in companies, which elected their Mobility Manager) and citizens.*

*Several other cultural activities (conferences, demonstration stands exposing new electric vehicles and Car/Bike Sharing service) were promoted and organized in order to spread off the culture of sustainable mobility also thanks to the support of many associations (Amici della Bici FIAB, ACI, Cooperativa CAUTO, etc.).*



Fig.9: Newspaper items released in occasion of the European Sustainable Mobility Weeks (2009 and 2010 edition)



Fig.10: Free Tickets voucher distributed during the European Mobility Week 2009

## B5 Inter-relationships with other measures

As the common objective is to set up specific communication campaigns in order to promote alternative solutions for the urban mobility, the measure from a theoretical point of view has potential interactions with the following measures:

- M.04.01 Mobility marketing;
- M.04.06 Mobility management actions (car pooling).

It should be underlined that the indicators were set up in order to measure the impacts of the specific actions carried out in this measure, without bundling effect with the other measures mentioned above.

## C. Evaluation – methodology and results

The measure was characterized by a heterogeneous set of activities; therefore the efforts towards the Public Transport users' cultural shift (in particular addressed to young people) were evaluated measuring the specific actions undertaken by the Transport Company Brescia Trasporti (BST).

In particular, it was measured the success/failure of the cultural initiatives "EDU" project, "Running words" literary contest and some activities promoted during the European Sustainable Mobility Week.

As clearly emerged in the building of the BaU scenario, the first two projects are relatively not well consolidated in Brescia and CIVITAS strongly contributed in keeping and systematizing such activities. The "European Sustainable Mobility Week" was considered quite consolidated, but CIVITAS contributed to maintain the commitments in organizing the events notwithstanding the risk of abandonment potentially offered by the political alternation in the city administration.

### C1 Measurement methodology

Indicators were divided into two macro-categories: "main indicators" and "complementary ones". Main indicators were able to evaluate the measure efficiency in terms of objectives achievement. The complementary indicators were introduced in order to assess specific issues and to better understand the measure performance at local level.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Economy	Number of kids using school buses at the primary school per year/Number of kids at the primary school per year	Three different kind of databases: Omnibus Card database (subscribers) and Family Card database both of BST (for the numerator); general database of Public Instruction Division	Main Indicator First data collection after the OP: school year 2008/2009
2	Transport	Quality of service	Information from Brescia Trasporti Customer satisfaction database	Complementary Indicator First data collection after the OP: May 2010
3	Society	Awareness level	Specific question added to the Brescia Trasporti regular Customer satisfaction	Main Indicator Ex ante lost. First data collection after the OP: November 2010

No.	Impact	Indicator	Data used	Comments
4	Society	Acceptance level	Specific question added to the Brescia Trasporti regular Customer satisfaction	Main Indicator Ex ante lost. First data collection: November 2010
5	Society	Number of teachers involved in training/total number of involved schools	internal EDU database of Brescia Trasporti	Main Indicator First data collection after the OP: school year 2009/2010
6	Society	Number of schools attending EDU/total number of primary schools	internal EDU database of Brescia Trasporti and Brescia schools census	Main Indicator First data collection after the OP: school year 2009/2010
7	Society	Number of students attending EDU/total number of students in primary schools (per year)	internal EDU database of Brescia Trasporti and database of Public Instruction Division	Main Indicator First data collection after the OP: school year 2009/2010
8	Society	Number of people involved in Brescia Running words/total number of people involved in the National Project	BST database and national ASSTRA census	Main Indicator First data collection after the OP: 2010
9	Society	Number of Brescia tales published	BST database	Complementary Indicator First data collection after the OP: 2010
10	Society	Number of PT passengers in EU mobility week - in town without my car day-/average number of people usually transported	BST database	Main Indicator First data collection after the OP: 2011
11	Society	Number of PT passengers in EU mobility week - in town without my car day-/number of PT passengers in EU mobility week -in town without my car day- in the previous year	BST database	Main Indicator First data collection after the OP: 2011

Detailed description of the indicator methodologies:

- **Indicator 1** (NUMBER OF KIDS USING SCHOOL BUSES AT THE PRIMARY SCHOOL PER YEAR/NUMBER OF KIDS AT THE PRIMARY SCHOOL PER YEAR) - Number of kids using PT was estimated by means of Omnibus Card database (subscribers) and Family Card database (Family Card is a special card for kids under 12 years old: they can travel free followed

by a parent or a grandparent with a valid ticket charged on Omnibus Card). Both the data collected were referred to subscribers and not to occasional travellers. All the data above were compared with number of kids registered at a specific school year at the primary school.

- **Indicator 2 (QUALITY OF SERVICE)** - Quality of service is usually measured by means of customer satisfaction survey, periodically carried out by Brescia Trasporti: this survey is composed by specific questions related to the eight customer satisfaction's indicators and a specific global customer satisfaction indicator that resume quality of service. Interviewed people express a judgement giving a mark from 1 (very unsatisfied) to 10 (very satisfied).
- **Indicator 3 (AWARENESS LEVEL)** – Awareness level of the initiatives is measured during customer satisfaction survey introducing a specific question. Question was defined on the basis of which project needed to be monitored.
- **Indicator 4 (ACCEPTANCE LEVEL)** – Awareness level of the initiatives is measured during customer satisfaction survey introducing a specific question. Question was defined on the basis of which project needed to be monitored.
- **Indicator 5 (NUMBER OF TEACHERS INVOLVED IN TRAINING/TOTAL NUMBER OF INVOLVED SCHOOLS)** – This indicator was measured by the comparison between the number of teachers involved in the project and total number of schools of Brescia Municipality involved in the project.
- **Indicator 6 (NUMBER OF SCHOOLS ATTENDING EDU/TOTAL NUMBER OF SCHOOLS)** – This indicator was measured by the comparison between the number of schools attending EDU and total number of school in Brescia Municipality.
- **Indicator 7 (NUMBER OF STUDENTS ATTENDING EDU/NUMBER OF STUDENTS IN SCHOOL PER YEAR)** – Number of people involved in the project (from internal EDU database built by Brescia Trasporti and database of Public Instruction division) was compared with number of student in school each year.
- **Indicator 8 (NUMBER OF PEOPLE INVOLVED IN BRESCIA RUNNING WORDS/TOTAL NUMBER OF PEOPLE INVOLVED IN THE NATIONAL PROJECT)** – Number of people involved in the project (from Running words' database – Brescia Trasporti) was compared with people involved in national project (from ASSTRA database). This indicator consists in the comparison between the number of non-professional writers that are involved in Brescia "Running words" and the total amount of people involved in the National project that was the result of the sum of the number of people that took part to the other local contests (this data collection was on charge of ASSTRA)
- **Indicator 9 (NUMBER OF BRESCIA TALES PUBLISHED)** – Number of tales published on Brescia Trasporti web site.
- **Indicator 10 (NUMBER OF PT PASSENGERS IN EU MOBILITY WEEK - IN TOWN WITHOUT MY CAR DAY-/AVERAGE NUMBER OF PEOPLE USUALLY TRANSPORTED)** – Data on Public Transport passengers came from databases of statistics in Brescia Trasporti: ticket-printings were collected during all the year. This indicator was the result of the comparison between the number of passengers transported during the unique ticket day (in occasion of the initiative “in town without my car day” in EU Sustainable Mobility Week) and the average number of people usually transported every day.
- **Indicator 11 (NUMBER OF PT PASSENGERS IN EU MOBILITY WEEK - IN TOWN WITHOUT MY CAR DAY-/NUMBER OF PT PASSENGERS IN EU MOBILITY WEEK -IN**

TOWN WITHOUT MY CAR DAY- IN THE PREVIOUS YEAR) – Data on Public Transport passengers came from BST databases: they collect ticket-printings during all the year. This indicator was the result of the comparison among the years between the number of passengers transported during the unique ticket day and showed the LPT passengers trend.

## C1.2 Establishing a Baseline

Brescia Trasporti is the LPT Company of Brescia and is part of the Brescia Mobilità Holding, whose main objective is traditionally to plan and manage, with an integrated approach, several activities concerning mobility, according to the municipal administration policies.

In years, Brescia Trasporti promoted activities and campaigns, addressed to specific target users, toward the sustainable mobility culture spread.

The Measure focused on 3 different initiatives dealing with that topics:

- "EDU" project;
- "European Mobility week";
- "Running words" project.

The baseline of the measure was built almost referring to the different initiatives as described in the tables reported below, except for indicator 2 "Quality of service", that gave a general perception on Public transport quality. For this latter indicator, the baseline value was referred to the customer satisfaction survey carried out in May 2008.

General perception of Quality of PT service	BASELINE (May 2008)
2) Quality of Service (Synthetic judgment)	7,02 /10
<i>Tab.1: Indicator 2 baseline</i>	

Indicators for EDU project	BASELINE school year 2007/2008
1) Number of kids using school buses at the primary school per year/Number of kids at the primary school per year	2,3%
5) Number of teachers involved in training/number of schools involved in the project	81%
6) Number of schools attending EDU/total number of primary schools	26%
7) Number of students attending EDU/total number of students in primary schools (per year)	23%

Tab.2: Indicators 1, 5, 6, 7 baseline

Running words	BASELINE year 2009
8) Number of people involved in Brescia Running words/total number of people involved in the National Project	11/1235
9) Number of Brescia tales published	11

Tab.3: Indicators 8, 9 baseline

European mobility week	BASELINE September 2007
10) Number of PT passengers in EU mobility week - in town without my car day-/average number of people usually transported	0,45
11) Number of PT passengers in EU mobility week - during in town without my car day -/number of PT passengers in EU mobility week – during in town without my car day - in the previous year	+54,98%

Tab.4: Indicators 10, 11 baseline

### C1.3 Building the Business-as-Usual scenario

The city of Brescia attended many past editions of the European “Sustainable Mobility Week”, offering a rich set of cultural initiatives. Such activities were arranged in collaboration with other bodies, such as the University of Brescia and several associations (“Amici della Bici-FIAB”, “ACI”, “Cooperativa CAUTO”, etc.). These events aimed at promoting and sensitizing public awareness about the sustainable mobility issues. In particular, the city of Brescia paid special attention to the presentation of new electric vehicles and to the Car/Bike Sharing service. As a matter of fact, thanks to some regional funding, the city of Brescia installed small columns for the electric cars refuelling, increased the Bike Sharing stations and, through the implementation of the CIVITAS Measure M06.05 “Car sharing in Brescia” promoted Car Sharing.

Brescia Trasporti significantly contributed to the organization of the activities, supporting the different initiatives and offering incentives for the use of Local Public Transport during the Sustainable Mobility Week.

The BaU scenario for the indicators referred to this initiative (Indicator n.10 “Number of PT passengers in EU mobility week –during in town without my car day -/average people usually transported” and 11 “Number of PT passengers in EU mobility week –during in town without my car day - /number of PT passengers in EU mobility week – during in town without my car day - in the previous year”) was built basing on the available historical data set.

European mobility week	BaU year 2012
10) Number of PT passengers in EU “Sustainable Mobility Week “- in town without my car day-/average number of people usually transported	1,05
11) Number of PT passengers in EU mobility week - during in town without my car day - /number of PT passengers in EU mobility week – during in town without my car day - in the previous year	+ 15%
<i>Tab.5: Indicators 10, 11 BaU</i>	

Taking into consideration the other cultural initiatives scheduled by the measure, it’s important to highlight that in the course of time the Transport Company took part to the "EDU" and “Running words” projects since 2007. Both these projects can be considered communication activities: in the first case, the objective consisted in involving children, teaching the importance of using sustainable means of transport and, in particular, of the Local PT. It was very interesting to notice that "EDU" project acted on the cultural shift, investing on the future city users. In the second case, through the promotion of the literary contest “Running words” (which consists in collecting travel stories written by the Local Public Transport users), Brescia Trasporti tried to involve its own users offering them the possibility to express themselves. The participation to the contest foresaw the presentation of the travel novels to Brescia Trasporti, the award of the best 5 tales and the possibility to attend the national contest.

These activities were in line with the special attention given by the transport company to its own users, showing them the image of an efficient company, in step with the times and attentive towards customers. Among other things, customers have been constantly involved in periodic customer satisfaction surveys, in order to investigate users’ opinion about the overall quality of service.

Indicator n.2 “Quality of service” is calculated using the results of the customer satisfaction survey which BST carries out 3 times a year (April, July and November) among its customers. The survey is administered by phone and face to face among a sample of 1200 LPT users. Interviewed people are asked to answer to 8 questions, giving a judgment going from 1 (very unsatisfied) to 10 (very satisfied). In particular, the questions concern the following topics: time spent to reach the destination; accuracy in time keeping; availability of tickets; safety about thefts and pickpocketing; buses internal cleanliness; drivers helpfulness and courtesy; information about timetables and routes; Brescia Trasporti’s attention for reduction of pollution.

The 8 marks are then synthesized into a unique value, expressing the overall quality of service provided by BST. Therefore, for the BaU building a sufficient series of numeric historical data was available for a projection to the 2012 time horizon (see figure 11). The obtained BaU value was referred to November 2012.

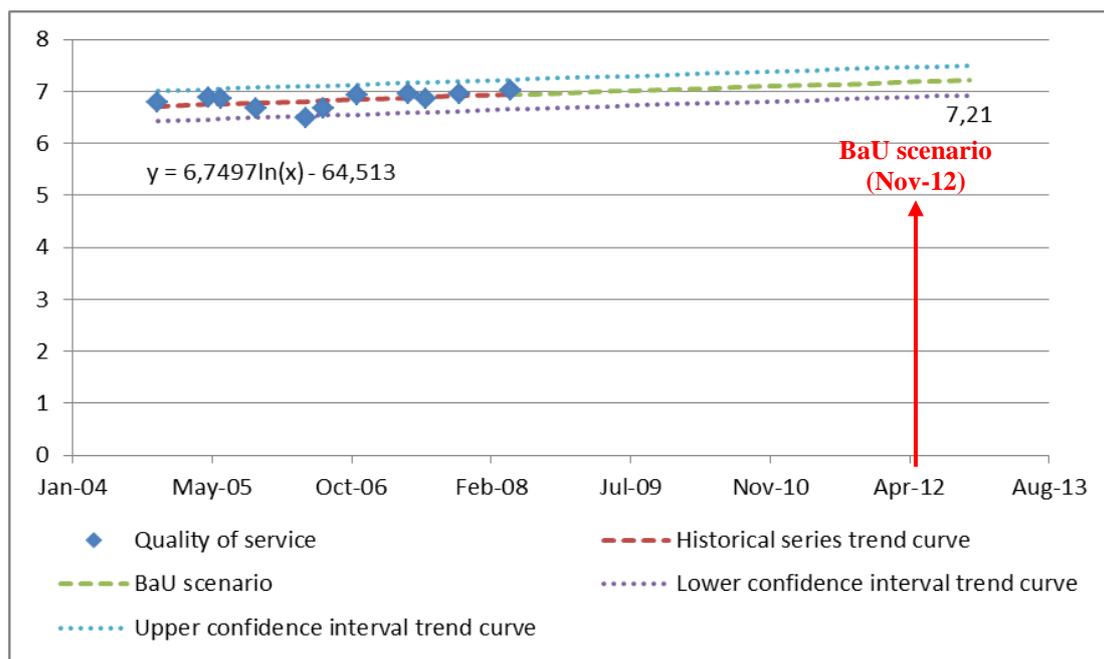


Fig.11: Quality of service

General perception of PT service quality	BaU year 2012
2) Quality of Service (Resuming judgment)	7,18/10

Tab.6: Indicator 2 BaU

Taking as reference the two projects ("EDU" and "Running words"), unfortunately it was evident, from the Fig. 12 and 13, a general decreasing number of participants just after the beginning of the Civitas Operative Phase (OP). It's important to remark that the OP of this measure was the school year 2009/2010, whose programmes were set during the summer 2009.

In order to build the BaU scenario it's important to make the following considerations.

As regards the EDU project, notwithstanding an overall increase of the students who could potentially be involved in the project, the number of participants registered a decrease since school year 2008/2009. The possible reasons of the decrease during the first Civitas project year (before the OP) are the following:

- recently, the school reform, has reduced the laboratory activities (and the resources allocated for them) for all the classes, so that at regional and national level it has been registered an overall reduction of the participation to educational campaigns;
- some difficulties have been noticed in contacting directly the schools, in order to insert the educational campaigns in the school year programme, and in involving teachers: it could have produced a progressive decrease of the educational campaign success.

- besides, interviews to some officers who work at the Province of Brescia and who usually organize activities for schools brought out the fact that in the last years the availability of free projects increased (such as road safety campaigns organized by the local police, campaigns organized by local associations, etc.), therefore teachers often decide to participate to all of them, changing project every year.

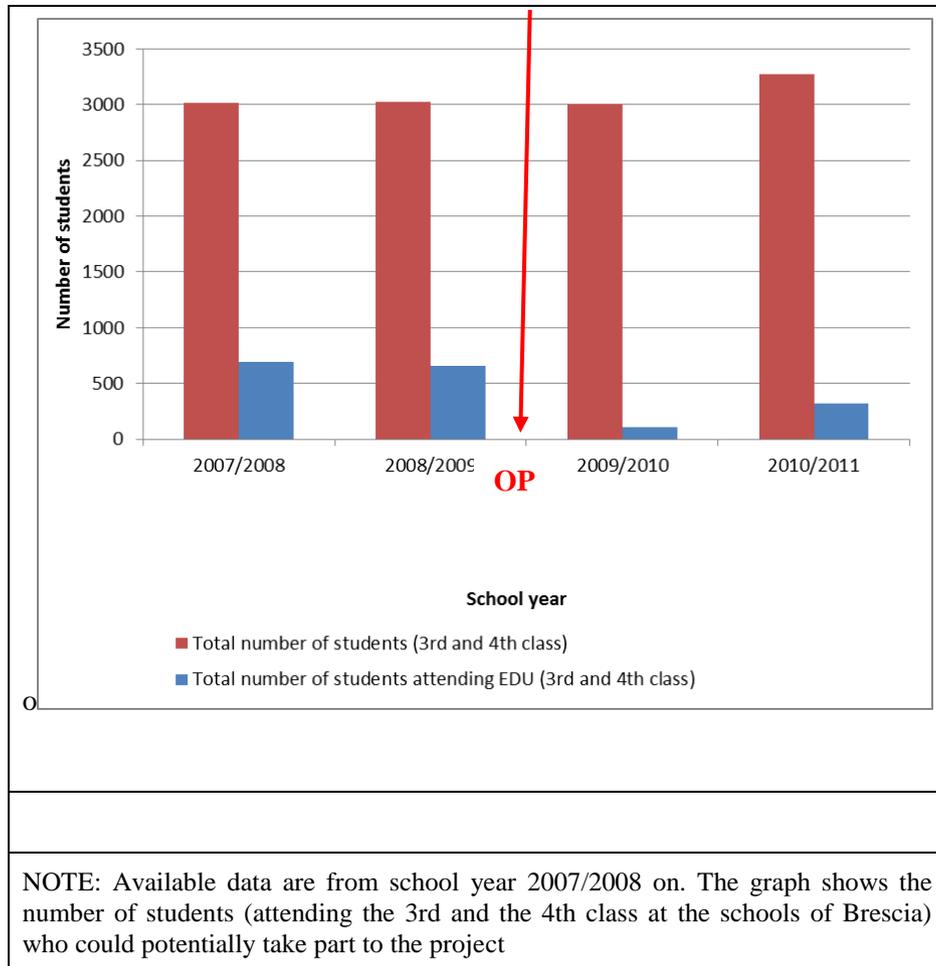


Fig. 12 Evolution of the participation to the EDU project

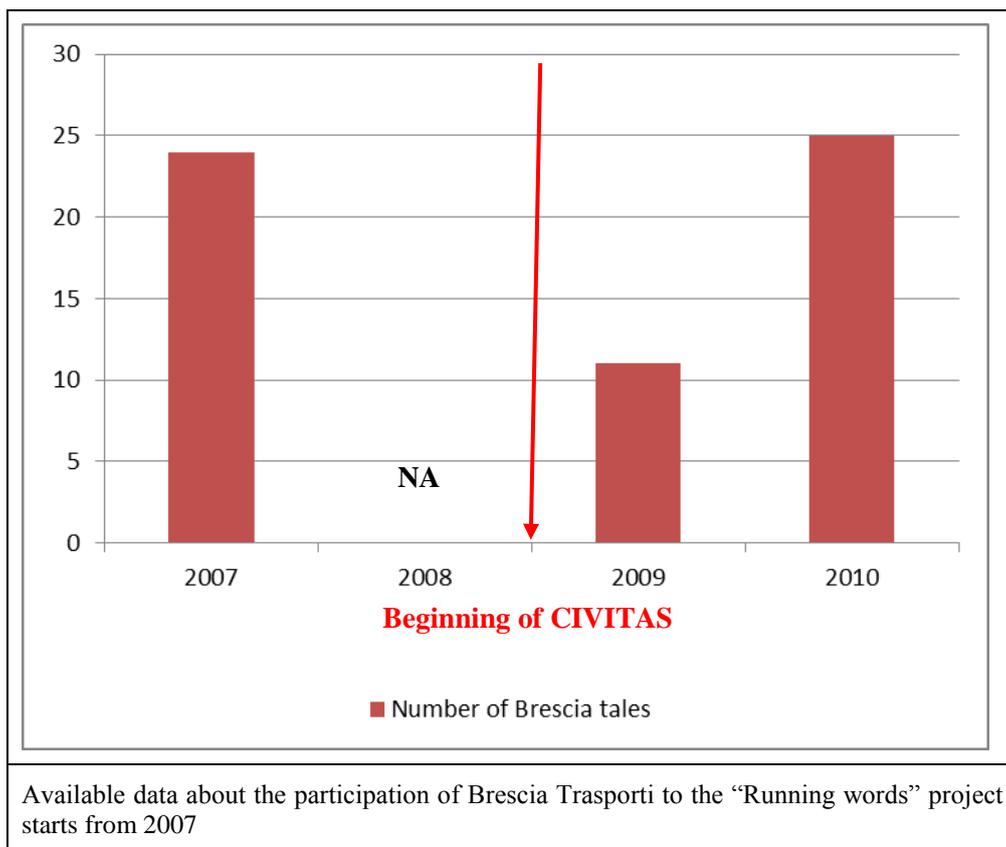


Fig.13: Number of submitted tales for the Brescia Running Word literary contest

Thanks to these considerations, for the indicator n.1 “Number of kids using school buses at the primary school per year/Number of kids at the primary school per year” the BaU was obtained projecting historical data up to school year 2011/2012. For Indicator 5 “Number of teachers involved in training/total of schools involved in the project” these further considerations about the 2 historical data were done: in school year 2007/2008 the number of involved teachers (9) equals the number of teachers who directly joined the EDU project; in school year 2008/2009, the 21 teachers include also those teachers who make co-presence in classrooms. The school reform, which reduced the co-presence in classrooms, can be considered an external factor, independent from CIVITAS. Because of many educational modules disappearance and of the school hours reduction (from 27 to 24 hours a week), it’s possible to assume that the number of involved teachers in the BaU scenario (school years 2009/2010, 2010/2011 and 2011/2012) would have been 15, equal to the mean value of the previous pilot projects trend (school years 2007/2008 and 2008/2009). As regards the “total number of involved schools” (indicator 6), because of the school hours reduction and of an oversupply of free educational projects, it was assumed that the number of schools involved in EDU would have decreased (from 11 to 9 involved schools), while the total number of schools was assumed to be the same (42 schools). Therefore, the indicator n.6 value in the BaU scenario would decrease from 0,26 to 0,21. As regards indicator n. 7 (Number of students attending EDU/total number of students in primary schools per year), the number of students attending EDU has been weighted considering the number of schools involved in the project which was estimated for the BaU scenario of the indicator 6. It’s important to highlight that the project is addressed to 3<sup>rd</sup> and 4<sup>th</sup> classes of the primary schools. As historically, the number of children attending the 3<sup>rd</sup> or 4<sup>th</sup> classes in Brescia are about an average of 40% of the total number of the primary school students and sections in each school are on average 1,81, it was assumed, for the BaU scenario, that 16 classes would have been involved in EDU project (corresponding to 304 students, as on average there are about 19 students per classroom, basing on the kids primary school database). The total number of students in primary school attending the 3<sup>rd</sup> and the

4<sup>th</sup> classes was estimated projecting the historical data series available for the indicator n.1. Finally, the BaU scenario for the school year 2009/2010 was set 1550 students attending the 3<sup>rd</sup> class and 1493 the 4<sup>th</sup>. The BaU scenario for the school year 2010/2011 was set 1497 students attending the 3<sup>rd</sup> class and 1485 the 4<sup>th</sup>. The BaU scenario for the school year 2011/2012 was set 1486 students attending the 3<sup>rd</sup> class and 1477 the 4<sup>th</sup>.

Indicators for EDU project	BaU school year 2011/2012
1) Number of kids using school buses at the primary school per year/Number of kids at the primary school per year	0,1
5) Number of teachers involved in training/total of schools involved in the project	1,6
6) Number of schools attending EDU/total of primary schools	0,21
7) Number of students attending EDU/total of students in primary schools (per year)	0,10

Tab.7: Indicators 1, 5, 6 and 7 BaU

Regarding building the BaU for “Running words” project, it has to be underlined that Brescia Traporti didn’t take part to the 2008 edition (Fig. 13). Thanks to Civitas, which made possible the participation to the next editions, the initiative was reintroduced and the number of participants registered an encouraging increase in 2010, contrary to the national trend, which was characterized by a significant decrease (from 1235 tales presented in 2009 to 869 in 2010). Therefore, without the Civitas project, the values of indicators 8 “Number of people involved in Brescia Running words/total of people involved in the National Project” and 9 “Number of Brescia tales published on web/total number of tales” can be considered 0, as the project wouldn’t have been implemented.

Running words	BaU year 2012
8) Number of people involved in Brescia Running words/total of people involved in the National Project	0
9) Number of Brescia tales published on web/total number of tales	0

Tab.7: Indicators 8 and 9 BaU

As a general consideration of the BaU results, starting from the previous BaU indicators values, it has been possible to assume that the organization of the European “Sustainable Mobility Week” is a consolidated event for Brescia, as since 1999 the city increasingly arranges events during the week that goes from 16<sup>th</sup> to 22<sup>nd</sup> September in collaboration with different stakeholders. The success of the initiative demonstrates that, notwithstanding the alternation of the administration in the management of the city, the Public Administration interest in supporting sustainable mobility has never decreased (see Fig. 14).

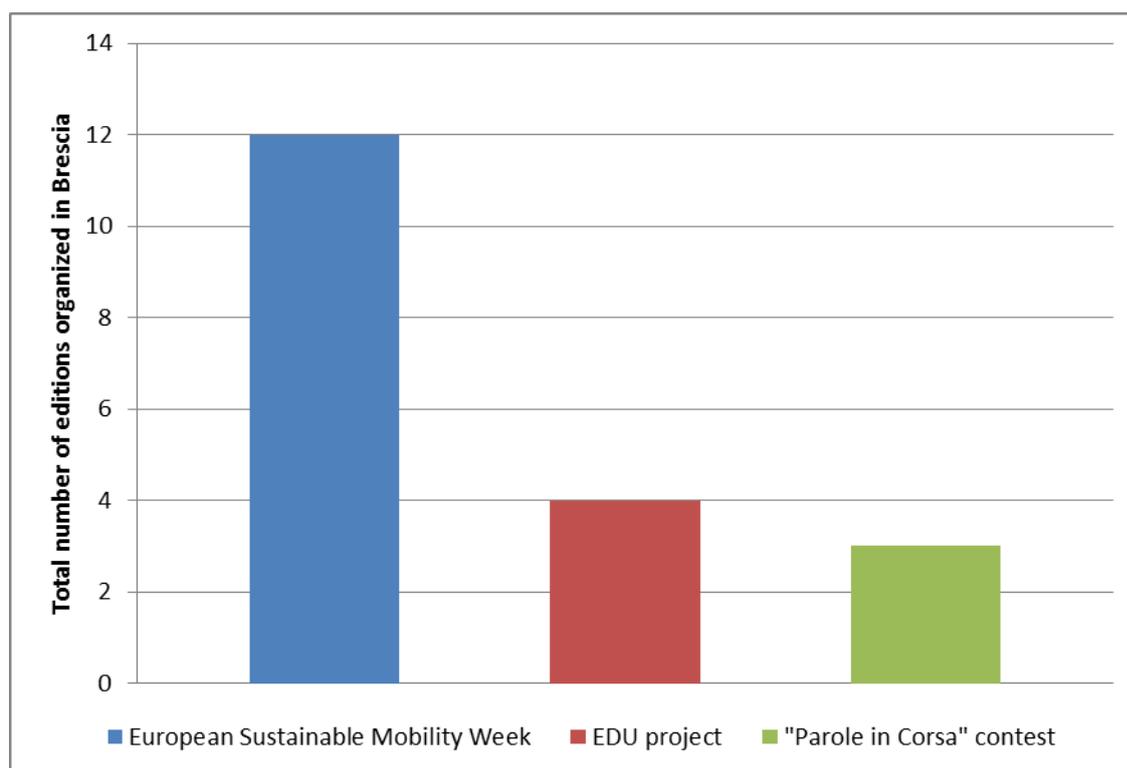


Fig.14: Total number of editions organized in Brescia

Therefore, the BaU scenario without CIVITAS could reasonably be the perpetuation of the European “Sustainable Mobility Week” initiative. The educational campaign EDU (started at national level in 2007) and the literary contest “Running words” (promoted at national level since 2002, to which Brescia Trasporti participate since 2007) would have been occasional events: as a matter of fact, they were the results mainly of the Brescia Trasporti initiative, that was influenced by the instable trend of the number of participants.

## C2 Measure results

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

### C2.1 Economy

Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”

Indicator	Before (school year 2007/2008)	After (variable)	B-a-U (variable)	Difference: After – Before	Difference: After – B-a-U
1. Number of kids using school buses	2,3%	(school year 2008/2009)=3,2%	(school year 2008/2009)=1,9%	0,9%	1,3%

Indicator	Before (school year 2007/2008)	After (variable)	B-a-U (variable)	Difference: After –Before	Difference: After – B-a-U
at the primary school per year/Number of kids at the primary school per year		(school year 2009/2010)=1,9%	(school year 2009/2010)=1,5%	-0,4%	0,4%
		(school year 2010/2011)=1,9%	(school year 2010/2011)=1,1%	-0,4%	0,8%

During Civitas indicator n.1 “Number of kids using school buses at the primary school per year/Number of kids at the primary school per year” showed a decreasing trend toward a stable value of 1,9% (school years 2009/2010 and 2010/2011). This was probably due to the new school organizational policies recently implemented by the School Department of the Municipality of Brescia: the door-to-door school bus service is going to be cut soon (the School Department of the Municipality of Brescia wanted to cut it in 2010 due to the lack of funding –and the service was not guarantee at the beginning at the school year, than there was a political agreement and it was decided to substantially modify this bus service within next year). New forms of mobility for primary schools students were promoted by the Municipality, such as the “pedibus” (going on foot service), at the expense of the "conventional" school bus. Alongside this, from 2013 the school bus service will be object of further changes: a minimum number of subscribers will be needed and only people living in areas which are not served by the LPT service will have access to this service.

## C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category “Transport”**

Indicator	Before (May 2008)	After (variable)	B-a-U (variable)	Difference: After –Before	Difference: After – B-a-U
2. Quality of service	7,02 /10	Nov 2009= 7,01/10	Nov 2009= 7,03 /10	-0,01	-0,02
		May 2010= 7,12/10	May 2010= 7,06/10	0,10	0,06
		Nov 2010= 7,14/10	Nov 2010= 7,09/10	0,12	0,05
		May 2011=7,22/10	May 2011=7,12/10	0,20	0,10
		July 2011= 7,17/10	July 2011= 7,13/10	0,15	0,04
		Nov 2011= 7,19/10	Nov 2011= 7,15/10	0,17	0,04
		May 2012=7,02/10	May 2012= 7,18/10	0	-0,16

Indicator n.2 (quality of service) was selected to give a general idea of the users' perception about LPT. During the Civitas OP this indicator registered a slight increasing trend.

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category "Society"**

Indicator	Before (variable)	After (variable)	B-a-U (variable)	Difference: After – Before	Difference: After – B-a-U
3. Awareness level	<b>No ex ante</b> is available because no specific questions have been inserted in customer satisfaction survey	(1 <sup>st</sup> data collection Nov 2010) 0,33% of people is aware about EDU (November 2011): 2,74% (May 2012): 2,68%	Not Assessable	Not Assessable	Not Assessable
4. Acceptance level	<b>No ex ante</b> is available because no specific questions have been inserted in customer satisfaction survey	(1 <sup>st</sup> data collection Nov 2010) 0,33% of people is aware about EDU (November 2011): 2,74% (May 2012): 2,68%	Not Assessable	Not Assessable	Not Assessable
5. Number of teachers involved in training/number of schools involved	School year (2007/2008) = 0,81	School year (2009/2010)=1,75	School year (2009/2010)=1,6	0,94	0,15
		School year (2010/2011)=1,67	School year (2010/2011)=1,6	0,86	0,07
		School year (2011/2012)=0,78	School year (2011/2012)=1,6	-0,03	-0,82
6. Number of schools attending EDU/total of primary schools	School year (2007/2008)=0,26	School year (2009/2010)=0,10	School year (2009/2010)=0,21	-0,16	-0,11
		School year (2010/2011)=0,14	School year (2010/2011)=0,21	-0,12	-0,07
		School year (2011/2012)=0,40	School year (2011/2012)=0,21	0,17	0,22
7. Number of	School year	School year	School year	-0,20	-0,07

Indicator	Before (variable)	After (variable)	B-a-U (variable)	Difference: After – Before	Difference: After – B-a- U
students attending EDU/total of students in primary schools (per year)	(2007/2008)=0,23	(2009/2010)=0,03	(2009/2010)=0,10		
		School year (2010/2011)=0,10	School year (2010/2011)=0,10	-0,13	0,00
		School year (2011/2012)=0,35	School year (2011/2012)=0,10	0,12	0,25
8. Number of people involved in Brescia Running words/total of people involved in the National Project	Year 2009: 11/1235=0,0089	Year 2010: 25/869=0,0288	Year 2010: 0	0,0199	0,0288
9. Number of Brescia tales published	Year 2009: 11	Year 2010: 25	Year 2010: 0	14	25
		Year 2011: 23	Year 2011: 0	12	23
10. Number of PT passengers in EU “mobility week” – during in town without my car day - /average people usually transported	Year 2007: 0,45;	(“in town without the car” 2010 Edition wasn't arranged)  Year 2011: 1,19	Year 2011: 0,94	0,74	0,25
11. Number of PT passengers in EU “mobility week” - during in town without my car day - /number of PT passengers in EU “mobility week” - during in town without my car day - in the previous year	Year 2007: +54,98%;	(“in town without the car” 2010 Edition wasn't arranged)  Year 2011: 100%	Year 2011: +17%	+45,02%	+83%

Indicators n.3 and 4 “Awareness level” and “Acceptance level” about the EDU project registered an increasing trend after the Measure OP (school year 2009/2010) and reached the stable value of about 2,7% of people aware of the EDU project and disposed to take part to it.

During Civitas, indicator n.5 “Number of teachers involved in training/number of schools involved” after an initial increase respect to the “Before” situation, registered a decrease, probably not because of the failure of the initiative, but because the number of teachers involved decreased, as more classes were assigned to each teacher.

Indicators n. 6 “Number of schools attending EDU/total of primary schools” and 7 “Number of students attending EDU/total of students in primary schools” after an initial decrease (school years 2009/2010 and 2010/2011) registered a strong increase, because an external specialized company was charged of the organizational activities concerning the project. Likely, in the future this provisional success could be stopped because of the significant cut to the school projects resource assignment.

Indicators 8 “Number of people involved in Brescia Running words/total of people involved in the National Project” and 9 “Number of Brescia tales published”, concerning the "Running words" national project, registered by positive trends in Brescia since year 2010, registering an increasing number of participants, compared to of the national trend, which generally decreased (in 2010 the number of tales published at national level decreased by 30% respect to the 2009 edition).

As regards the “in town without my car” initiative, which was occasionally organized during the European “Sustainable Mobility Week” the available data are really few. But thanks to the collection of the indicators n. 10 “Number of PT passengers in EU mobility week - during in town without my car day-/average people usually transported” and 11 “Number of PT passengers in EU mobility week – during in town without my car day - /number of PT passengers in EU mobility week –during in town without my car day - in the previous year”, it was possible to observe that when this activity was arranged, it obtained a great success. In particular, the after data collection of indicator n. 11 showed in 2011 an increase by 100% of the number of passenger respect to the previous year. This data could be misleading because the previous year the initiative wasn't organized. If the indicator was calculated using data referred to the previous edition (the 2007 edition is the first one available) the increase would go up to 121%, so passengers were more than doubled).

Civitas has been a precious driver to keep many initiatives alive and the results taken from the indicators listed above highlighted that a stronger continuity to the initiatives was ensured.

### C3 Achievement of quantifiable targets and objectives

The following table shows the key objectives and numerical targets of the measure and the relative degree of achievement.

No.	Target	Rating
1	<p>Promotion of the national project EDU, to involve about 30% of the students of 3rd and 4th class registered for the school year in progress</p> <p><i>This objective was considered achieved.</i></p> <p><i>The specific indicators able to express numerically this achievement are the following:</i></p> <p><b>ind. 7</b> <i>Number of students attending EDU/total of students in primary schools (per year):</i></p> <p><i>Before (School year 2007/2008) = 23%</i></p> <p><i>After (School year 2011/2012) = 35%</i></p> <p><i>Other indicators measured the success (in terms of participation) of the project in general:</i></p> <p><b>ind. 5</b> <i>Number of teachers involved in training/number of schools involved</i></p> <p><i>Before (School year 2007/2008) = 0,81</i></p> <p><i>After (School year 2011/2012) = 0,80</i></p> <p><b>ind. 6</b> <i>Number of schools attending EDU/total of primary schools</i></p> <p><i>Before (School year 2007/2008) = 0,26</i></p> <p><i>After (School year 2011/2012) = 0,43</i></p> <p><i>NOTICE: Though the results were the same, it was important to note that during the implementation of the measure it was possible to recovery a sharp decrease of initial participation.</i></p>	*
2	<p>Promote the national project "Running words";</p> <p><i>This objective was considered achieved in full because since year 2009 the initiative has been arranged every year.</i></p> <p><i>There are specific indicators able to express the success of the initiative, namely:</i></p> <p><b>ind. 8</b> <i>(Number of people involved in Brescia Running words/total of people involved in the National Project)</i></p> <p><i>Before (Year 2009) = 11/1235</i></p> <p><i>After (year 2011) = 25/869</i></p> <p><b>ind. 9.</b> <i>(Number of Brescia tales published)</i></p> <p><i>Before (Year 2009) = 11</i></p> <p><i>After (year 2011) = 23</i></p>	***

No.	Target	Rating
3	<p>Organization and support of the European “Sustainable Mobility Week” (in each year)</p> <p><i>This objective was considered achieved in full because every year the initiative took place in Brescia and scheduled several activities, among which the “in town without my car” day. Even if this particular event wasn’t arranged in 2010, other initiatives were promoted yearly.</i></p> <p><i>There were specific indicators able to measure the success of the single initiative “In town without my car” day:</i></p> <p><b>ind. 10.</b> (Number of PT passengers in EU mobility week - in town without my car day - /average people usually transported)</p> <p><i>Before (Year 2007) = 0,45</i></p> <p><i>After (year 2011) = 1,19</i></p> <p><b>ind. 11.</b> (Number of PT passengers in EU mobility week - in town without my car day - /number of PT passengers in EU mobility week - in town without my car day - in the previous year)</p> <p><i>Before (Year 2007 respect to year 2006) = + 54,98%;</i></p> <p><i>After (year 2011 respect to year ...) = + 100%;</i></p>	***
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b></p> <p><b>** = Achieved in full       *** = Exceeded</b></p>		

## **C4 Up-scaling of results**

For this measure it's not possible to assess an up scaling, as the measure was already addressed to the whole potential participants (Brescia and its suburbs have about 400.000 inhabitants) all over the schools (with the "EDU" project), all over the PT users (with the "Running words" contest) and, in general the all city (with the European "Sustainable Mobility week" events).

## **C5 Appraisal of evaluation approach**

The indicators were selected in order to evaluate the achievement of the measure objectives and they belong to three categories: "Economy", "Transport" and "Society".

The indicators which belong to the category "Economy" such as Indicator n.1 "Number of kids using school buses at the primary school per year/Number of kids at the primary school per year" and to the category "Transport" such as Indicator n.2 "Quality of service" were useful to evaluate the level of measure goals achievement. The indicator n.2 was considered complementary, as it was related only to the local context. Indicator n.1 allowed to estimate the number of kids using PT by means of the Omnibus Card database and to compare the collected data with the number of kids registered at the primary school. Indicator n.2, instead, allowed to resume the overall quality of service because it was collected through periodic customer satisfaction survey carried out among the LPT users.

All the other indicators were included in the category "Society" and were useful to monitor specifically the success of the three promoted initiatives (the contest "Running Words", the "EDU" project" and the European Sustainable Mobility Week).

## **C6 Summary of evaluation results**

The main purpose of the project was the implementation of initiatives able to contribute to the cultural shift towards more sustainable forms of mobility.

The key results are as follows:

- **Key result 1** – Thanks to Civitas project, the continuity to the activities traditionally carried out in Brescia, to promote sustainable mobility, was ensured, also improving the information spreading in the city.
- **Key result 2** – The number of students attending the "EDU project", respect to the number of students attending the 3rd and 4th class at the primary schools, increased from 23% (school year 2007/2008 before Civitas) to 35% (school year 2011/2012).
- **Key result 3** – The promotion of the national project "Running words" was improved. Considering the obtained results during the measure implementation, it was pointed out that the interest for "Running words project significantly increased more than doubling the number of participants (from 11 published tales in 2009 to 23 in 2011), despite the negative national trend (in 2010 the number of tales published at national level decreased by 30% respect to the 2009 edition).
- **Key result 4** – The organization of the European "Sustainable Mobility Week" was a consolidated tradition in Brescia, as since 1999 the city has arranged many events during the week that goes from 16th to 22nd September in collaboration with different stakeholders. The increasing success of the initiative "in town without the car" during Civitas demonstrated that,

notwithstanding the politic alternation in the management of the city, the Public Administration interest in supporting sustainable mobility didn't decrease also thanks to the presence of a significant European project such as Civitas.

## **C7 Future activities relating to the measure**

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The activities implemented in the measure will surely continue also after the end of the CIVITAS project, because they are a consolidated and effective way to spread out sustainable mobility culture in Brescia.

## **D. Process Evaluation Findings**

### **D.0 Focused measure**

This measure is not a focused one.

#### **D1 Deviations from the original plan**

No significant deviations from the original plan were foreseen.

#### **D2 Barriers and drivers**

In the following we summarise under key headings some of the barriers and drivers experienced during the implementation of the measure.

##### **D2.1 Barriers**

###### **Preparation phase**

No barriers encountered.

###### **Implementation phase**

**Involvement/communication barrier** - in the first two editions of the project during the Civitas Operational Phase (school years 2009/2010 and 2010/2011) a worsening of the participation to the "EDU" initiative was registered, probably due to some difficulties in promoting the project among the School Districts and in reaching the interested teachers: this was basically due to the very complex organization of the scholastic institutions. Notwithstanding the several solicitations by telefax, e-mail and telephone, only few schools joined the project. Some problems were encountered in including the educational campaigns in the school year programs. During the project life, some recovery actions were implemented.

###### **Operational phase**

**Involvement barrier** - the recent school reform arranged in Italy reduced the laboratory activities (and the resources allocated for them) for all the classes, so that at regional and national level it was registered an overall reduction of the participation to educational campaigns.

##### **D2.2 Drivers**

###### **Preparation phase**

**Planning driver** - it must be underlined that Brescia Traporti didn't take part to the 2008 edition of the project "Running Words". Thanks to Civitas, which made possible the participation to the next editions, the initiative was reintroduced and the number of participants registered an encouraging increase in 2010, contrary to the national trend (in 2010 the number of tales published at national level decreased by 30% respect to the 2009 edition).

**Planning driver** - A general attitude of Brescia Trasporti in showing special attention to the quality of service;

**Cultural driver** - "Running words" project helps to perceive the trip using the public transport, not only as a necessity, but also as a pleasure, paying particular attention and to the passengers' trip experience;

### **Implementation phase**

**Positional driver** - there was a strong coordination among all the involved partners (Brescia Trasporti, Municipality of Brescia, Brescia University and Brescia Mobilità) in organizing the "European Sustainable Mobility Week" events, because of its importance in the strategic framework of the city.

### **Operational phase**

**Positional driver** - an accurate planning of the projects during the previous years (by means of experimental editions) allowed the adoption of the final design of the projects ahead on scheduled times.

## **D2.3 Activities**

### **Preparation phase**

**Institutions involvement** - Institutions involvement was necessary: Education Department of the Municipality was able to transmit to the schools the information about all the proposed initiatives with more strength;

### **Operational phase**

**Involvement of a specialized company during the recruitment phase** - For the "EDU" edition 2011/2012, interviews to some officers, who worked at the Province of Brescia and who usually organized activities for schools, brought out the fact that in the last years the availability of free projects increased (such as road safety campaigns organized by the local police, campaigns organized by local associations, etc.). Therefore teachers often decided to participate to all of them, changing project every year. It was decided to involve, during the recruitment phase, a company specialized in education and training with direct and constant contact with schools, to reach more pointedly and directly the teachers, with information about the project. They were very well-established in the scholastic's field and so they were more effective in the recruitment and collection of the schools adhesions.

## **D3 Participation**

### **D.3.1 Measure partners**

- **Brescia Trasporti s.p.a.** - the company, which managed the LPT in Brescia, promoted "Running words" and "EDU" project in the measure implementation and was an active partner in the organization of "European sustainable Mobility Week" events.
- **Brescia Municipality** - the Municipality undertook to promote and organize the "European sustainable Mobility Week" events each year during Civitas project.

### **D.3.2 Stakeholders**

- **Teachers, students and families** - they were involved in the "EDU" project implementation carried out at school. The students awakening helped to inform also families towards the LPT use.
- **Associations (such as Amici della bici, ACI, Car-sharing and bike sharing society –i.e. Brescia Mobilità - )** - several associations were each year involved in the organization of the "European Sustainable Mobility Week", in order to share and define also useful information to spread and to organize dedicated spaces during the week.
- **Brescia citizens** – they were involved in the implementation of the events of the "European Sustainable Mobility Week", to be informed and make them aware about sustainable means of transport available in Brescia. Moreover, they were involved in "Running words", as LPT users.
- **PT users and ASSTRA** - PT users were involved in "Running words", as foreseen by the project. ASSTRA provided the information about the "Running words" project participation at national level.

## **D4 Recommendations**

### **D4.1 Recommendations: measure replication**

No particular recommendations can be gathered.

### **D4.2 Recommendations: process**

- **Recommendation 1: A good organization** - The calendar of initiatives, which will be promoted, should be defined quite in advance, to assure the highest level of coordination and the best activities sharing among the involved partners. Alongside this, it's important to promote the campaigns and the initiatives in an integrated way among the different authorities in charge of organizing the initiatives, in order to share the issues and the implementation phases (both in terms of time and contents).
- **Recommendation 2: Have a look at the European initiatives** – It's important to participate to the European initiatives such as the European Sustainable Mobility Week, in order to give higher visibility to the local events, and to increase their success. Alongside this, to share the events promoted at European level helps the city in supporting the sustainable mobility policies.
- **Recommendation 3: Targeted users** – It's important to select the specific users to which address the educational campaigns and to adapt the topics to them. For example, as regards the educational campaigns at school it's fundamental to propose specific topics to children according to their age and transport needs.
- **Recommendation 4: Toward a smart city** – Cultural events such as the "Running Words" project can be useful to spread the idea of "smart city". As a matter of fact, a "smart city" is not smart only from the technological point of view but also in terms of spreading the culture

of a sustainable mobility also thanks to initiatives such as the literary contests on board of the PT.

## Annex 1: Historical data series for the BaU calculation

- **Indicator 1** - *(Number of kids using school buses at the primary school per year/Number of kids at the primary school per year)*

Details about the number of kids at the primary school per year is not available (both in the historic database and in the actual database) and has been estimated as a **mean value** calculated on the general database of Public Instruction Division. More information can be found in the indicator description.

**Omnibus Card database elaboration** – data mining of the records with the following features:

- Subscription of the Omnibus Card from 2005 to 2008
- Age at the moment of the subscription form 6 to 10 (years of primary school attending)

### Family Card database

The Family Card initiative and related database begin in 2005, but until February 2007 783 records have not a related subscription date. In order to correct this non homogeneous data, the subscriptions before February 2007 have been proportionally allocated on the basis of the distribution of the subscriptions of years 2007 and 2008 per age

### Kids at primary school database

Number of kids at the primary school per year has been estimated as a medium value from the general database of public instruction division of the Municipality, because details on registered kids per year were not available (both in the historic database and in the actual database). Available data:

- Average number of kids for class is the result of the comparison between “total number of registered kids per school”/”number of classes of the school”.
- Number of classes for scholastic year (1st, 2nd, 3rd, 4th, 5th)
- Average number of kids for scholastic year is the result of “a”(average number of kids for class) \* ”b” (average number of class for scholastic year)

Up to the school year 2009/2010 the number of classes per year is available at a disaggregate level (divided by classes). From the school year 2010/2011 the same data are provided aggregated (not divided by classes), therefore an estimation has been made.

### Historical data series:

year	classes														
	1st			2nd			3rd			4th			5th		
	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)
2005	49	1451	3,38%	49	1533	3,20%	61	1539	3,96%	52	1512	3,44%	29	1498	1,94%
2006	58	1495	3,88%	56	1446	3,87%	62	1550	4,00%	63	1541	4,09%	29	1529	1,90%

2007	33	1511	2,18%	34	1513	2,25%	33	1473	2,24%	38	1544	2,46%	39	1561	2,50%
2008	42	1408	2,98%	23	1524	1,51%	36	1541	2,34%	36	1485	2,42%	35	1569	2,23%

a. Number of kids using busses at primary school per year (totals from Omnibus Card and Family Card database data mining)

b. Number of kids at primary school per year

c. Percentage of kids using busses at primary school per year (a/b)\*100

**Tab.A1.1: data from Kids at primary school database**

Subscription year	Age (years old)				
	6	7	8	9	10
Database Omnibus Card					
2005	1	2	7		
2006	10	9	8	11	
2007	15	4	7	11	21
2008	9	3	4	7	22
Database Family Card					
2005	48	47	54	52	29
2006	48	47	54	52	29
2007	18	30	26	27	18
2008	33	20	32	29	13

**Tab.A1.2: data from Kids at primary school database**

- Indicator 2 (Quality of service)** - The interviews are 1200 repeated 3 times a year (April, July and November) and are carried out to Brescia Trasporti customers: 700 face to face and 500 by phone. The sample is drowned in two different ways: for face to face interview at the bus stops the place are identified on the basis of the lines, the end of the line or specific parts of lines; for the interview by phone there is a random sample from Omnibus Card database (subscribers) on the basis of ticket used.

This indicator and the related questions above are measured with the same methodology since 2004.

**Historical data as following:**

Indicator	nov-04	May-05	Jul-05	Nov-05	May-06	Jul-06	nov-06	May-07	Jul-07	nov-07	May-08
Time spent to reach	6,31	6,47	6,71	6,25	6,43	6,52	6,55	6,47	6,72	6,84	7,25

Indicator	nov-04	May-05	Jul-05	Nov-05	May-06	Jul-06	nov-06	May-07	Jul-07	nov-07	May-08
destination											
Accuracy in time keeping	6,06	5,94	5,89	5,49	5,36	5,96	6,41	6,1	6,84	6,63	6,87
Availability of tickets	7,76	7,67	7,18	7,54	8,01	8,1	8,48	8,48	8,11	8,19	7,45
Safety about thefts and pickpocketing	6,83	6,76	6,67	6,3	6,15	6,42	6,53	6,77	6,59	6,69	6,72
Busses' internal cleanliness	6,58	6,8	6,59	6,17	6,02	5,82	5,77	6,39	5,92	5,99	6,28
Drivers' helpfulness and courtesy	7,26	7,65	7,62	7,51	7,02	7,64	7,96	7,25	7,21	7,19	7,94
Information about timetables and routes	7,75	7,83	7,67	7,68	6,91	7,13	7,39	7,02	6,68	7,21	6,88
Brescia Trasporti attention for reduction of pollution	5,9	5,98	6,63	6,45	6,12	5,9	6,24	7,11	6,87	6,83	6,79
<b>Synthetic judgment (total Customer Satisfaction indicator)</b>	<b>6,8</b>	<b>6,88</b>	<b>6,87</b>	<b>6,67</b>	<b>6,5</b>	<b>6,68</b>	<b>6,92</b>	<b>6,95</b>	<b>6,87</b>	<b>6,94</b>	<b>7,02</b>

Tab.A1.3: historical data from the Brescia Trasporti customer survey

- **Indicator 5** – (Number of teachers involved in training/total of schools involved in the project)

**Ex ante situation** concerns the two experimental edition during 2007/2008 and 2008/2009 scholastic years as following:

School year	Teachers involved	School involved
2007/2008	9	11
2008/2009	21	11

Tab.A1.4: experimental edition - EDU project

- **Indicator 6** – *(Number of schools attending EDU/total of the schools)*

This local indicator is measured by the comparison between the number of schools attending EDU and total number of school in Brescia Municipality.

**Ex-ante** concerned in data collection of the two experimental years of EDU project before CIVITAS start and the situation is the following:

school year	(a) total number of schools attending EDU	(b)* Total number of schools	Indicator 6 (a/b)	(c) total number of classes attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> )	(d)* Total number of classes (3 <sup>rd</sup> and 4 <sup>th</sup> )	coefficient (c/d)
2007/2008	11	42	0,26	37	157	0,24
2008/2009	11	42	0,26	33	157	0,21

\*this data are the result of the elaboration reported for indicator 1 on the general database of public instruction division of Municipality

**Tab.A1.5: data collection of the two experimental years of EDU project before CIVITAS**

- **Indicator 7** – *(Number of students attending EDU/Number of students in school per year)*

Disaggregation per year is not available and we have estimated it (data used for indicator 1).

Number of kids at the primary school per year is estimated as a medium value from the general database because details on registered kids per year are not available (both in the historic database and in the actual database)

The data available concerned in data collection of the two experimental years of EDU project before CIVITAS start and the situation is the following:

school year	(a) Total number of students attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> class)	(b) Total number of students target of EDU = average number of students per year (3 <sup>rd</sup> and 4 <sup>th</sup> class from indicator 1)	Indicator 7 (a/b)
2007/2008	692	3017 (1473+1544)	0,23
2008/2009	655	3026 (1541+1485)	0,22

**Tab.A1.6: data collection of the two experimental years of EDU project before CIVITAS**

- **Indicator 8** - (Number of people involved in Brescia Running words/total of people involved in the National Project)

**Data available:**

The national ASSTRA representative has been contacted in order to get the national data. The following data have been provided:

A= people involved in Brescia Running words =11

B = people involved in the National Project =1235

C = A/B = 0,89 %

Company	City	2009
ANM	Napoli	Didn't take part to the initiative
ARPA	Chieti	Didn't take part to the initiative
ACTV	Venezia	Didn't take part to the initiative
AMAT	Palermo	Didn't take part to the initiative
ANM	Napoli	Didn't take part to the initiative
STP	Brindisi	Data not available
CTM	Cagliari	Data not available
Tempi Agenzia	Piacenza	Data not available
Trambus	Roma	Data not available
ATAC	Roma	Data not available
Cotral	Roma	Data not available
Metro	Roma	Data not available
TevereTPL	Roma	Data not available
CSTP	Salerno	Data not available
ATP	Salerno	Data not available
Train	Siena	Data not available
GTT	Torino	500
ATAF	Firenze	200
APM	Perugia	179
ATM	Alessandria	81
ATC	Terni	69

Company	City	2009
AMI/Adriabus	Urbino	65
ATP	Sassari	58
MetrocampaniaNordEst	Napoli	30
RAMA	Grosseto	21
CTT	Pistoia	21
BresciaTrasporti	Brescia	11
<b>Totals</b>		<b>1235</b>

**Tab.A1.7: national data from ASSTRA about "Running words" project**

- **Indicator 9** – (Number of Brescia tales published)

**Data available:** (\*) 2008 Running Words contest edition hasn't been arranged

YEARS(*)	Number of BRESCIA tales published
2007	24
2009	11

**Tab.A1.8: number of Brescia tales published for "Running words" project**

- **Indicator 10** – (*Number of PT passengers in EU mobility week - in town without my car day-/average people usually transported*)

This local indicator is the result of the comparison between the number of passengers transported during the unique ticket day (in occasion of the initiative "in town without my car day" in EU Sustainable Mobility Week) and the average number of people usually transported every day.

*List of Unique ticket days:*

18<sup>th</sup> September 2005

17<sup>th</sup> September 2006

22<sup>nd</sup> September 2007

20<sup>th</sup> September 2008

September 2009

The ex ante situation is the following:

Year	(a) average passengers in unique ticket day	(b) average passengers/day	Indicator (a/b) 10
2005	not available	104.563	-
2006	33.541	109.382	<b>0,31</b>
2007	51.984	114.056	<b>0,45</b>
2008	126.974	117.127	<b>1,08</b>
2009	66.964	117.382	<b>0,57</b>

**Tab.A1.9: number of Brescia tales published for "Running words" project**

- **Indicator 11** – (Number of PT passengers in EU mobility week - in town without my car day-/number of PT passengers in EU mobility week -in town without my car day- in the previous year)

**Data available:**

Year	(a) Passengers	(b) Passengers of the previous year	Indicator 11 [(a-b)/b]*100 (%)
2005	Not available	Not available	-
2006	33.541	Not available	-
2007	51.984	33.541	+ <b>55%</b>
2008	126.974	51.984	+ <b>144%</b>
2009	66.964	126.974	- <b>47%</b>

**Tab.A1.10: data available for "In town without my car" initiative**

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1** - *(Number of kids using school buses at the primary school per year/Number of kids at the primary school per year)*

### Ex ante data collection:

Details about the number of kids at the primary school per year is not available (both in the historic database and in the actual database) and has been estimated as a **medium value** calculated on the general database of Public Instruction Division. We have considered number of kids using PT service because school busses are offered as the result of a special agreement between Municipality, schools and Brescia Trasporti and give a non significant result about effective use of PT. We have merged two databases: Omnibus Card database (subscribers) and Family Card database (under 12 special offer).

**Omnibus Card database elaboration** – data mining of the records with the following features:

- a. Subscription of the Omnibus Card Age at the moment of the subscription form 6 to 10 (years of primary school attending)

### Family Card database

The Family Card initiative and related database begin in 2005, but until February 2007 783 records have not a related subscription date. In order to correct this non homogeneous data, the subscriptions before February 2007 have been proportionally allocated on the basis of the distribution of the subscriptions of years 2007 and 2008 per age

### Kids at primary school database

Number of kids at the primary school per year has been estimated as a medium value from the general database of public instruction division of the Municipality, because details on registered kids per year were not available (both in the historic database and in the actual database). Available data:

- d. Average number of kids for class is the result of the comparison between “total number of registered kids per school”/”number of classes of the school”.
- e. Number of classes for scholastic year (1st, 2nd, 3rd, 4th, 5th)
- f. Average number of kids for scholastic year is the result of “a”(average number of kids for class) \* ”b” (average number of class for scholastic year)

Up to the school year 2009/2010 the number of classes per year is available at a disaggregate level (divided by classes). From the school year 2010/2011 the same data are provided aggregated (not divided by classes), therefore an estimation has been made.

**Ex ante situation** - considering the preliminary remarks above, the ex ante situation is as following:

- a. Number of kids using busses at primary school per year (totals from Omnibus Card and Family Card database data mining)

b. Number of kids at primary school per year

c. Percentage of kids using busses at primary school per year  $(a/b)*100$

		class/classes														
anno/ year	1st			2nd			3rd			4th			5th			
	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)	
2007/2008	42	1408	2,98%	23	1524	1,51%	36	1541	2,34%	36	1485	2,42%	35	1569	2,23%	

Tab.A2.1: data from Kids at primary school database

Term "a" of the above table)

Subscription year 2007/2008	Age (years old)				
	6	7	8	9	10
Database Omnibus Card	9	3	4	7	22
Database Family Card	33	20	32	29	13
Total "a"	42	23	36	36	35

Tab.A2.2: data of subscription year 2007/2008

Ind 1 year 2007/2008) = 2,296% = 2,3%

After data collection:

		class/classes														
anno/ year	1st			2nd			3rd			4th			5th			
	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)	a	b	c (%)	
2008/2009	65	1474	4,41%	37	1426	2,59%	47	1491	3,15%	45	1514	2,97%	37	1489	2,48%	
2009/2010	15	1544	0,97%	26	1494	1,74%	35	1562	2,24%	36	1586	2,27%	36	1560	2,31%	
2010/2011	15	1520	0,99%	6	1471	0,41%	7	1538	0,46%	4	1562	0,26%	24	1536	1,56%	

Tab.A2.3: data from Kids at primary school database

Ind 1 year 2008/2009) = 3,12% = 3,2%

Ind 1 year 2009/2010) = 1,906% = 1,9%

Ind 1 year 2010/2011) = 0,772% = 0,8%

- **Indicator 2 (Quality of service)** - The interviews are 1200 repeated 3 times a year (April, July and November) and are carried out to Brescia Trasporti customers: 700 face to face and 500 by phone. The sample is drowned in two different ways: for face to face interview at the bus stops the place are identified on the basis of the lines, the end of the line or specific parts of

lines; for the interview by phone there is a random sample from Omnibus Card database (subscribers) on the basis of ticket used.

Related questions:

9. Time spent to reach the destination
10. Accuracy in time keeping
11. Availability of tickets
12. Safety about thefts and pick pocketing
13. Busses' internal cleanliness
14. Drivers' helpfulness and courtesy
15. Information about timetables and routes
16. Brescia Trasporti attention for reduction of pollution

#### Ex-ante situation

Indicator	May-08
Time spent to reach the destination	7,25
Accuracy in time keeping	6,87
Availability of tickets	7,45
Safety about thefts and pickpocketing	6,72
Busses' internal cleanliness	6,28
Drivers' helpfulness and courtesy	7,94
Information about timetables and routes	6,88
Brescia Trasporti's attention for reduction of pollution	6,79
<b>Synthetic judgment (total Customer Satisfaction indicator)</b>	<b>7,02</b>

**Tab.A2.4: historical data from the Brescia Trasporti customer survey**

After data collection:

Indicator	May-10	Jul-10	nov-10	mag-11	Jul-11	Nov-11	mag-12
Time spent to reach the destination	7,36	8,32	7,44	7,36	7,18	7,44	7,25
Accuracy in time keeping	6,85	6,91	6,83	6,76	6,92	6,66	6,87
Availability of tickets	7,77	7,91	8,24	7,86	7,99	7,95	7,45
Safety about thefts and	6,28	6,42	6,3	6,8	6,68	6,61	6,72

pickpocketing							
Busses' internal cleanliness	6,45	6,67	5,86	6,49	6,67	6,47	6,28
Drivers' helpfulness and courtesy	7,58	7,45	7,8	7,53	7,5	7,66	7,94
Information about timetables and routes	7,36	7,4	7,44	7,46	7,14	7,65	6,88
Brescia Trasporti's attention for reduction of pollution	7,33	7,27	7,19	7,54	7,27	7,1	6,79
<b>Total Customer Satisfaction indicator</b>	<b>7,12</b>	<b>7,17</b>	<b>7,14</b>	<b>7,22</b>	<b>7,17</b>	<b>7,19</b>	<b>7,02</b>

Tab.A2.5: data from the Brescia Trasporti customer survey

- **Indicator 3** – (Awareness level)

**No ex ante** is available because no questions have not been inserted in customer satisfaction survey.

During the November 2009 customer any question has been introduced about awareness level. The indicator has been collected during the november 2010 survey as First data collection and it will be collected again during the july 2012 survey as Ex post.

**First data collection** (November 2010 BST customer)

The phrased question is the following: "Conosci il progetto EDU promosso da Brescia Trasporti nelle scuole?" (Do you know EDU project promoted by Brescia Trasporti in schools?). The results are reported below:

	Absolute values	%
People aware about EDU project	4	0,33%
People not aware about EDU project	1198	99,67%
Total	1202	100%

Tab.A2.6: data from the Brescia Trasporti customer survey

(November 2011 BST customer)

The phrased question is the following: "Conosci il progetto EDU promosso da Brescia Trasporti nelle scuole?" (Do you know EDU project promoted by Brescia Trasporti in schools?). The results are reported below:

	Absolute values	%
People aware about EDU project	34	2,74%
People not aware about EDU project	1208	97,26%
Total	1242	100%

**Tab.A2.7: data from the Brescia Trasporti customer survey**

- **Indicator 4** – (*Acceptance level*)

No **ex ante** is available because no questions have not yet been inserted in customer satisfaction survey.

During the November 2009 customer any question has been introduced about awareness level. The indicator has been collected during the November 2010 survey as **First data collection** and during the July 2012 survey it will be collected as Ex post data collection.

The first question added to the standard Customer was referred to the awareness level. The second one to the acceptance level. Only people who answered positively to the first question (0,33 %) was asked to answer also to the second one, therefore the acceptance level can be considered scarce.

- **Indicator 5** – (*Number of teachers involved in training/total of schools involved in the project*)

**Ex ante situation** concerns the experimental edition during 2007/2008 scholastic year as following:

School year	Teachers involved	School involved
2007/2008	9	11

**Tab.A2.8: data collection of the experimental years of EDU project before CIVITAS**

**After situation:**

School year	Teachers involved	School involved
2009/2010	7	4
2010/2011	10	6
2011/2012	14	18

**Tab.A2.9: data collection of the EDU project editions**

- **Indicator 6** – (*Number of schools attending EDU/total of the schools*)

This local indicator is measured by the comparison between the number of schools attending EDU and total number of school in Brescia Municipality.

**Ex-ante** concerned in data collection of the first experimental year of EDU project before CIVITAS start and the situation is the following:

school year	(a) total number of schools attending EDU	(b)* Total number of schools	Indicator 6 (a/b)	(c) total number of classes attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> )	(d)* Total number of classes (3 <sup>rd</sup> and 4 <sup>th</sup> )	coefficient (c/d)
2007/2008	11	42	0,26	37	157	0,24

**Tab.A2.10: data collection of the experimental EDU project edition**

\*this data are the result of the elaboration reported for indicator 1 on the general database of public instruction division of Municipality

**After situation:**

school year	(a) total number of schools attending EDU	(b)* Total number of schools	Indicator 6 (a/b)	(c) total number of classes attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> )	(d)* Total number of classes (3 <sup>rd</sup> and 4 <sup>th</sup> )	coefficient (c/d)
2009/2010	4	42	0,10	5	155	0,03
2010/2011	6	42	0,14	17	163,78	0,10
2011/2012	18	42	0,43	55	158,25	0,35

**Tab.A2.11: data collection of the EDU project editions**

\*this data are the result of the elaboration reported for indicator 1 on the general database of public instruction division of Municipality

- **Indicator 7** – (Number of students attending EDU/Number of students in school per year)

Disaggregation per year is not available and we have estimated it (data used for indicator 1).

Number of kids at the primary school per year is estimated as a medium value from the general database because details on registered kids per year are not available (both in the historic database and in the actual database)

**Ex-ante** concerned in data collection of the first experimental year of EDU project before CIVITAS start and the situation is the following:

school year	(a) Total number of students attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> class)	(b) Total number of students target of EDU = average number of students per year (3 <sup>rd</sup> and 4 <sup>th</sup> class from indicator 1)	Indicator 7 (a/b)
2007/2008	692	3017 (1473+1544)	0,23

**Tab.A2.12: data collection of the experimental EDU project edition**

**After situation:**

school year	(a) Total number of students attending EDU (3 <sup>rd</sup> and 4 <sup>th</sup> class)	(b) Total number of students target of EDU = average number of students per year (3 <sup>rd</sup> and 4 <sup>th</sup> class from indicator 1)	Indicator 7 (a/b)
2009/2010	103	3005 (1491+1514)	0,03
2010/2011	323	3148,06 (*)	0,10
2011/2012	1065	4635,01 (*) (**)	0,23

**Tab.A2.13: data collection of the EDU project editions**

(\*)Up to the school year 2009/2010 the number of classes per year is available at a disaggregate level (divided by classes). From the school year 2010/2011 the same data are provided aggregated (not divided by classes), therefore an estimation has been made.

(\*\*) in 2011/2012 edition have been considered as target also 5<sup>th</sup> class because of the new version of the project – phase 2 in the same scholastic year allow to involve also 5<sup>th</sup> class' students)

- **Indicator 8** – (*Number of people involved in Brescia Running words/total of people involved in the National Project*)

**Ex ante data collection:**

The national ASSTRA representative has been contacted in order to get the national data. The following data have been provided:

*A = people involved in Brescia Running words = 11*

*B = people involved in the National Project = 1235*

*C = A/B = 0,89 %*

Company	City	2009
ANM	Napoli	Didn't take part to the initiative
ARPA	Chieti	Didn't take part to the initiative
ACTV	Venezia	Didn't take part to the initiative
AMAT	Palermo	Didn't take part to the initiative
ANM	Napoli	Didn't take part to the initiative
STP	Brindisi	Data not available
CTM	Cagliari	Data not available
Tempi Agenzia	Piacenza	Data not available
Trambus	Roma	Data not available
ATAC	Roma	Data not available
Cotral	Roma	Data not available
Metro	Roma	Data not available
TevereTPL	Roma	Data not available
CSTP	Salerno	Data not available
ATP	Salerno	Data not available
Train	Siena	Data not available
GTT	Torino	500

Company	City	2009
ATAF	Firenze	200
APM	Perugia	179
ATM	Alessandria	81
ATC	Terni	69
AMI/Adriabus	Urbino	65
ATP	Sassari	58
MetrocampaniaNordEst	Napoli	30
RAMA	Grosseto	21
CTT	Pistoia	21
BresciaTrasporti	Brescia	11
<b>Totals</b>		<b>1235</b>

Tab.A2.14: national data from ASSTRA about "Running words" project

**After situation:**

The following data have been provided:

*A = people involved in Brescia Running words = 25*

*B = people involved in the National Project = 869*

$C = A/B = 0,03\%$

Company	City	2010 (itinere)
ANM	Napoli	130
ARPA	Chieti	130
ACTV	Venezia	95
AMAT	Palermo	70
ANM	Napoli	32
STP	Brindisi	Data not available
CTM	Cagliari	Data not available
Tempi Agenzia	Piacenza	Data not available
Trambus	Roma	Data not available
ATAC	Roma	Data not available

Company	City	2010 (itinere)
Cotral	Roma	Data not available
Metro	Roma	Data not available
TevereTPL	Roma	Data not available
CSTP	Salerno	Data not available
ATP	Salerno	Data not available
Train	Siena	Data not available
GTT	Torino	Didn't take part to the initiative
ATAF	Firenze	Data not available
APM	Perugia	176
ATM	Alessandria	43
ATC	Terni	65
AMI/Adriabus	Urbino	78
ATP	Sassari	Didn't take part to the initiative
MetrocampaniaNordEst	Napoli	Didn't take part to the initiative
RAMA	Grosseto	25
CTT	Pistoia	Didn't take part to the initiative
BresciaTrasporti	Brescia	25
Totals		869

**Tab.A2.15: national data from ASSTRA about "Running words" project**

- **Indicator 9** – (Number of Brescia tales published)

**Ex ante situation:**

YEARS(*)	Number of BRESCIA tales published
2009	11

(\*) 2008 Running Words contest edition hasn't been arranged

**Tab.A2.16: Number of Brescia tales published for "Running words" project**

**After situation:**

YEARS	Number of BRESCIA tales published
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2010	25
2011	23

Tab.A2.17: Number of Brescia tales published for "Running words" project

- **Indicator 10** – (Number of PT passengers in EU mobility week - in town without my car day-/average of people usually transported)

This local indicator is the result of the comparison between the number of passengers transported during the unique ticket day (in occasion of the initiative “in town without my car day” in EU Sustainable Mobility Week) and the average number of people usually transported every day.

The ex ante situation is the following:

Year	(a) average passengers in unique ticket day	(b) average passengers/day	Indicator 10 (a/b)
2007	51.984	114.056	0,45

Tab.A2.18: data available for "In town without my car" initiative

It's important to notice that the “unique ticket day” is a special offer for a holiday. Usually, the average number of passengers/holiday is lower than the average number of passenger /day (b) (including both working days and holidays).

For. eg. the average number of passengers/holiday in year 2008 was distributed as following:  
**Average number of passenger on Saturday** 98.424 **Average number of passenger on Sundays** 34.645

**After situation:**

The 2010 edition of the initiative “in town without my car day” hasn't been organized, therefore any data is available.

Year	(a) average passengers in unique ticket day	(b) average passengers/day	Indicator 10 (a/b)
2011	115.112	96.662	1,19

Tab.A2.19: data available for "In town without my car" initiative

- **Indicator 11** – (Number of PT passengers in EU mobility week - in town without my car day-/number of PT passengers in EU mobility week - in town without my car day - in the previous year)

**Ex ante situation** as following:

Year	(a) Passengers	(b) Passengers of the previous year	Indicator 11 [[a-b]/b]*100 (%)
2007	51.984	33.541	+54,98%

Tab.A2.20: data available for "In town without my car" initiative

**After situation:**

The 2010 edition of the initiative “in town without my car day” hasn’t been organized, therefore any data is available.

<b>Year</b>	<b>(a) Passengers</b>	<b>(b) Passengers of the previous year</b>	<b>Indicator 11 [(a-b)/b]*100 (%)</b>
2011	115.112	0	100%

**Tab.A2.21: data available for "In town without my car" initiative**

## M04.06 – Executive summary

The spread of the culture of sustainable mobility is fundamental to reduce the use of private cars and mobility management actions can play an important role in this direction. The already existing actions needed to be coordinated following a systematic approach, aiming at a coherent vision in promoting sustainable mobility.

The following main activities promoted by the Area Mobility Manager of the Municipality of Brescia have been implemented during the measure implementation:

- surveys among the main companies and schools located in Brescia concerning their travel behaviour during the home to work/school trips finalized to the elaboration of Home to Work Travel Plans (for companies) and to the proposal of specific mobility management actions (for schools);
- experimentation of the Car-pooling service;
- training activities addressed to the companies/schools Mobility Managers;
- promotion of the initiative “bike tag” and targeting of a booklet to inform citizens about the advantages of using bicycle, the available anti-theft systems and the solutions offered by the city of Brescia for the cycle mobility;
- organization of events during the "European Sustainable Mobility Week" in Brescia, such as the promotion of thematic conferences to share knowledge with citizens, the dissemination of the implemented activities in the city, the dissemination of the researches results about mobility improvement and the promotion of existing and new transport services.

The evaluation activities were layout selecting indicators able to assess the overall measure performance, focusing on the Car-pooling service experimentation, on the Home to Work Travel surveys and on the bike tag initiative. At the end of the evaluation activities it has been possible to make the following general considerations:

- the behavioural change in the citizens’ life style patterns is a complicated issue and the mobility management actions aren’t so able to significantly affect consolidated travel habits, especially in the short period;
- the Home to Work Travel survey to companies allowed to investigate the mobility habits of the involved companies: the positive results in terms of switch toward more “sustainable” means of transport cannot be associated only to the actions performed by the measure: the general period of economic crisis experienced in Italy favoured the collective transport solutions and cheaper fuel vehicle powering. On the contrary, the availability of mobility management actions (such as the economic incentives for the purchase of clean vehicles or the promotion of collective transport services) are particularly important in times of economic crisis, when people is more predisposed to change their mobility habits to more sustainable behaviours;
- the experimentation of the car-pooling service was made according to the measure objectives, but probably recurring to the wrong technological solution. This can be considered the main reason of its substantial failure. At the same time, a quite consolidated attitude toward more

spontaneous way of car-pooling was observed in Brescia, therefore, other solutions for the car-pooling initiative promotion should be found.

- At the end of Civitas the number of tagged bike didn't reach the expected objective, notwithstanding a slight increasing trend during the project. This can be due to several reasons: the scarce effectiveness of the system itself or of the promotional activities. Anyway, the initiative will be re-proposed in the future, trying to find out the best way to promote it.

CO<sub>2</sub> emissions have been calculated by using the results of to the Home to Work Travel surveys. The indicator cannot be representative of the whole city since it monitored the emissions produced by the vehicles used during the H/W trips of the interviewed employees.

The increasing trend observed between the 2010 survey and the 2012 one (+ 895.8 kgCO<sub>2</sub>) has just been due to the higher number of filled in questionnaires, even if the same number of companies was involved: as the indicator was calculated basing on parametric estimation of the CO<sub>2</sub> emission, a higher number of filled in questionnaires corresponded to a higher amount of kms declared by the interviewees, then to higher emissions levels.

According to the answers provided by the interviewees, the number of people driving alone increased (the average occupancy went from 1.27 in 2010 to 1.23 in 2012), but, at the same time, the people who shared their car (making a spontaneous car-pooling) carried a higher number of people during the home to work trips (the average occupancy in car-pooling went from 2.15 in 2010 to 2.28 in 2012).

Concerning the "modal split" characterizing the home-to-work trips, the number of people using local PT and non-motorized means of transport (train, urban and extra-urban busses, bicycle, pedestrian mode) significantly increased from 8.49% of people using these means of transport in 2010 to 14.66% in 2012, notwithstanding the slight increase registered by the use of cars. The use of powered two wheels decreased from 2.60% in 2010 to 2.24% in 2012. Additionally, an increasing number of methane gas powered vehicles has been encountered. Anyway, the positive results in terms of switch toward more "sustainable" means of transport cannot be associated only to the Mobility Management actions performed by the measure. The general period of economic crisis experienced in Italy favoured the collective transport solutions and cheaper fuel vehicle powering.

The testing car-pooling service at the Tridentina School has been analysed also by performing a Cost-Benefit Analysis. The results showed that the initial investment cost for the Car-pooling experimentation (19.950 €) can be re-paid in 15 years, thanks to the benefits associated to the emission and fuel saving, only if the total mileage covered by the car-pooling service will be 134'572 km.

This means that the car-pooling experience in Brescia, which was characterized by an exiguous number of km covered in 2011 during the experimentation (1'647 km), should increase the mileage covered in the next 15 years by 21.5% per year, in order to register 25'169 km in 2025 and to reach the cumulative value of 134'572 km (15 years).

## A. Introduction

### A1 Objectives

The measure objectives were:

(V) High level / longer term:

- To decrease CO<sub>2</sub> emissions according to Kyoto dispositions for Italy.

(W) Strategic level:

- To prevent and to reduce the atmospheric emissions for health and environment protection according to the Regional Law<sup>12</sup> about sustainable mobility in urban areas.

(X) Measure level:

(1) To influence the travel behaviours through promoting specific mobility management actions (addressed to the main companies or schools located in Brescia), namely:

- To involve about 50% of the main companies located in Brescia (with more than 150 employees (corresponding to about 15 companies), including more companies than the ones who fitted with D.L.27 march 1998 on “Sustainable mobility”<sup>13</sup>
- To elaborate Home to Work/School Travel Plans for each site;
- Car-pooling service experimentation avoiding about 150.000 km/year with 10 crews;
- To spread the culture of sustainable mobility increasing public transport use for the home to work trip (+1%);

(2) To increase the number of tagged bicycles in Brescia, reaching 6.000 tagged bikes;

(3) To involve about 20.000 people

### A2 Description

The spread of the culture of sustainable mobility is fundamental to reduce the use of private cars and the mobility management actions can play an important role in this direction. The activity of a Mobility Manager aims at spreading the culture of sustainable mobility and at promoting the use of alternative means of transport, proposing those actions, initiatives and plans which are able to go in that direction.

This measure consisted of some of the activities promoted by the Mobility Manager nominated by the Municipality of Brescia. Namely, the following activities were implemented:

- surveys among the main companies and schools located in Brescia concerning their travel behaviour during the home to work/school trips;

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<sup>12</sup> Lombardia Region Law 24/2006.

<sup>13</sup> Decree Law 27 March 1998 which instituted the Mobility Manager profile for the Companies/Public Bodies with more than 300 employees.

- elaboration of Home to Work Travel Plans as follows.  
A unique plan at aggregate level as demo activity was initially elaborated and then single Local Plans;
- promotion of the experimental Car-pooling service through the installation of a data logger on board able to automatically compose the crews and calculate the fares and actual experimentation of the system involving one school;
- training activities addressed to the companies/school Mobility Managers;
- in order to stimulate the use of bike among citizens, the initiative “bike tag” was promoted. At dissemination level a dedicated booklet was targeted to inform citizens about the advantages of using bicycle, the available anti-theft systems and the solutions offered by the city of Brescia for the cycle mobility (including the bike sharing service);
- in order to sensitize people in relation to the mobility management actions carried out by the Municipality of Brescia in collaboration with companies, events during the "European Sustainable Mobility Week" in Brescia were organized. For example the promotion of thematic conferences to share knowledge with citizens, the dissemination of the implemented activities in the city, the dissemination of the researches results about mobility improvement and the promotion of existing and new transport services (LPT, Bike sharing, Car sharing, etc.).

## B. Measure implementation

### B1 Innovative aspects

- New mode of transport exploited
- Targeting specific user groups
- New economic instrument

The innovative aspects of the measure are:

- **Innovative aspect 1 (New methodological approach)** – As regards the Travel Plans elaboration, respect to the traditional methodology suggested by the National guidance, an innovative approach was followed in Brescia. The Municipality of Brescia started from a wide survey which involved as much as possible the most significant companies located in the city (characterized by more than 150 employees). Basing on the results of the survey, the most interested companies were fully involved in the Home to Work Plan elaboration process. The Municipality of Brescia decided to elaborate an aggregate Home to Work Travel Plan starting from a demo activity deeply developed on a small sample of companies (6 out of the 12 fully involved in the process). This demo activity was useful to analyse the main mobility patterns of the employees and to formulate a standard set of proposals to be included into the single Travel Plans.
- **Innovative aspect 2 (Targeting specific user groups)** – The surveys about the Home to School/Work travel behaviour, had never been done before in Brescia. They were addressed to the main schools or companies located in Brescia. An important aspect to highlight was the special attention given in 2010 to the translation in Chinese, Urdu, Punjabi, Arabian, Bengalese of the Home-School questionnaires into foreign languages, in order to reach a wider number of families (as Schools in Brescia registered a high number of students of immigrates families).
- **Innovative aspect 3 (Incentives)** – The Mobility Management actions promoted by the Municipality of Brescia scheduled incentives in order to increase the likelihood of succes of the surveys, such as the organization of a lottery with interesting prizes for those employees who filled in the questionnaires, special fares for car assurances and possibility to park in reserved parking lots for the car-pooling subscribers (in some cases and for limted period of time also economic incentives for ecological mopeds/CNG cars purchase were provided).
- **Innovative aspect 4 (New mode of transport exploited)** – The experimentation of the car-pooling service was considered an innovative transport solution, as in Brescia this kind of service didn't exist before the Civitas project, except for the organization of crews based on spontaneous initiative. The experimentation proposal was made to the Mobility Managers of the main schools/companies of the City, informing them about the potential suitability (both from an economic and an environmental point of view) of the car-pooling respect to the individual means of transport. The proposed Car-pooling system foresaw the installation on board of a special identification device, able to register all the information about the created crew and to calculate automatically the costs to be shared among the travellers through the use of a specific SW.

## **B2 Research and Technology Development**

The most significant aspects relating to the RTD applied in Brescia regard the companies involvement process and the way to organize the surveys made by the Municipality of Brescia for understanding the travel behaviours of the main schools/companies located in the city, in order to layout specific actions, such as the Home to Work Travel Plans.

Here the main RTD activity linked to the home to Home to Work Plans elaboration process is reported.

- survey which involved as much as possible the most significant companies located in the city. About 2600 employees were surveyed from companies with more than 150 employees (corresponding to about 25 companies);
- involvement of the most interested companies (about 12) in the Home to Work Plan elaboration process;
- draft scheme of the Home to Work Travel Plan shared with the 12 companies involved in the process;
- demo activity deeply developed on 6 out of the 12 companies fully involved in the process;
- final elaboration of an aggregate Home to Work Travel Plan based on a standard set of proposals to be included into the single Travel Plans.

Here the main RTD activity linked to the home to schools survey conduction is reported.

As regard the surveys focused on Schools, preliminary meeting were arranged with the Headmasters to introduce the project and the objectives of the survey. The necessity of translating the questionnaires also into foreign languages emerged (Chinese, Urdu, Punjabi, Arabian, Benaglese) in order to involve in the survey also the foreign families.

## **B3 Situation before CIVITAS**

Since 2002 the Municipality of Brescia has been promoting some mobility management actions in Brescia, according to an Italian national law, which schedules the nomination of a Mobility Manager and the elaboration of "Travel Plans" for the most important Companies/Public Bodies (the Decree 27 March 1998 scheduled the nomination of a Mobility Manager for all those companies with more than 300 employees).

Before CIVITAS, the Travel Plans had never been realized and the undertaken activities were sporadic and limited to single company initiatives.

The already existing actions needed to be coordinated following a systematic approach, aiming at a coherent vision in promoting sustainable mobility.

There was also the necessity to coordinate, train and support the Mobility Managers nominated by the involved companies/public bodies, as often they aren't technicians or professionals specialised in mobility issues.

The mobility manager of Brescia is also the "Area Mobility Manager" (i.e. the person) in charge of coordinating the activities carried out by the single companies through their Mobility Managers

## **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

- **Stage 1: Survey campaigns, involvement of the stakeholders and elaboration of the Home to Work/School Travel Plans** (from October 2008 to August 2010) – The survey campaigns were made in April-May 2010 and involved the main companies and school complexes located in Brescia. The surveys aimed at understanding travel behaviours for the layout of specific Home to School/Work plans. The main objective of these Plans, according to the Italian law, is to find out mobility solutions for the improvement of the travel quality, promoting the use of means of transport alternative to the private car, such as LPT, car-pooling, bicycle and bike-sharing, etc.. The elaboration of Travel Plans usually foresees the following steps:

- a survey phase,
- a description of the actual present situation
- the identification of the activities,
- the elaboration of the Plans.

Two different surveys were promoted by Brescia Municipality, one specifically addressed companies (including universities) the other specifically addressed to primary and secondary schools.

In order to increase the likelihood of success of the surveys also some incentives were also promoted, such as the organization of a lottery with interesting prizes for those employees who filled in the questionnaires, special fares for car assurances and possibility to park in reserved parking lots for the car-pooling subscribers, economic incentives for ecological mopeds/CNG cars purchase, etc.

## **1) ACTIVITIES RELATING TO HOME TO WORK TRAVEL PLAN**

### **Home to Work survey**

In 2010 survey - addressed to the companies with more than 150 employees - about 2600 questionnaire were filled in by the employees (corresponding to about 25 companies).

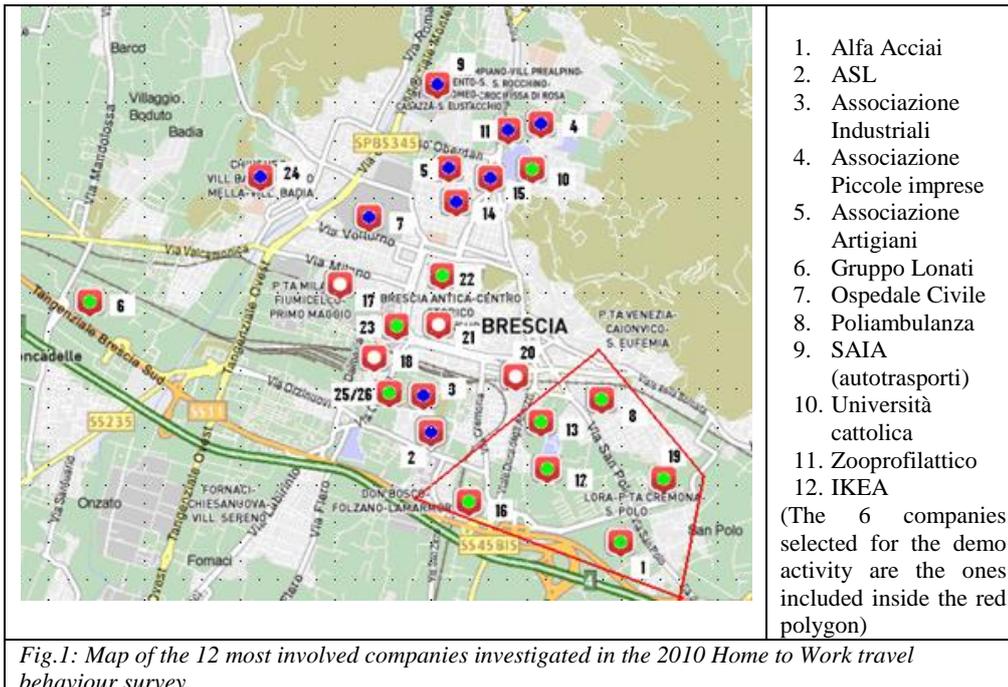
The collected database provided useful information about the mobility patterns of a representative set of companies located in the city of Brescia such as:

- the modal split,
- the kind of vehicles used in systematic trips,
- the reasons of the used vehicle,
- travel timings, etc.

In the questionnaire specific questions were also inserted to investigate the attitude of involved people to change their behaviour towards other means of transport, alternative to the individual ones.

### **Involvement of the stakeholders**

12 out of the 25 companies were considered “fully involved” (see the Fig. 1 “Map of the 12 most involved companies investigated in the 2010 Home to Work travel behaviour survey”), as they contributed with more enthusiasm to the survey initiative, compiling the most part of the questionnaires. Therefore, in the Home to Work Travel Plans elaboration process the Municipality of Brescia decided to focus the attention on the results coming from this particular set of companies and to share with them a draft aggregate Home to Work Travel Plan.



As initial demo activity, the draft Plan foresaw to further focus the attention on 6 particular companies (see Fig. 1) aiming to point out the standard mobility actions to be then included in each single Home to Work Plans.

#### **Elaboration of the Home to Work Travel Plan**

The final aggregate Home to Work Travel Plan included the following standard proposals:

- ✓ to favour the LPT use introducing special ticket fare thanks to apposite agreements made with the LPT company;
- ✓ to favour cycle mobility for the H/W trips improving the parking availability, agreeing special fares for the bikes repair/purchase, etc.;
- ✓ to favour higher vehicle occupancy suggesting the car sharing among the employees and proposing the experimentation of a Car-pooling system based on the data logger installation and on the automatic calculation of the crews and fares;
- ✓ to make communication campaigns to inform employees about the Mobility Management actions.

#### **Elaboration of the single Home to Work Travel Plans**

As final activity a total number of 15 single Home to Work Travel Plans were then elaborated, including the proposals to be implemented thanks to the collaboration of the Mobility Managers nominated by each site:

- Alfa Acciai
- ASL
- Associazione Industriali
- Associazione Piccole Imprese
- Associazione Artigiani
- Gruppo Lonati
- IKEA
- Ori Martin
- Ospedale Civile
- Palazzoli
- Poliambulanza
- Santoni
- SAIA (autotrasporti)

- Università Cattolica  
- Zooprofilattico.

## 2) ACTIVITIES RELATING TO HOME TO SCHOOL

### Home to school survey

As regard the surveys focused on the Schools, preliminary meeting were arranged with the Headmasters to introduce the objectives of the survey. The necessity of translating the questionnaires also into foreign languages emerged (Chinese, Urdu, Punjabi, Arabian, Bengalese) in order to involve also the foreign families in the survey.

During the survey campaign a total number of 20 schools joined the initiative (17 out of the 43 primary schools and 3 out of the 23 secondary schools, see Fig. 2 “Map of the 20 schools involved in the 2010 Home to School travel behaviour survey”) and 2.376 questionnaires were filled in, which allowed to collect information about the mobility needs of the students attending the involved schools and their families.

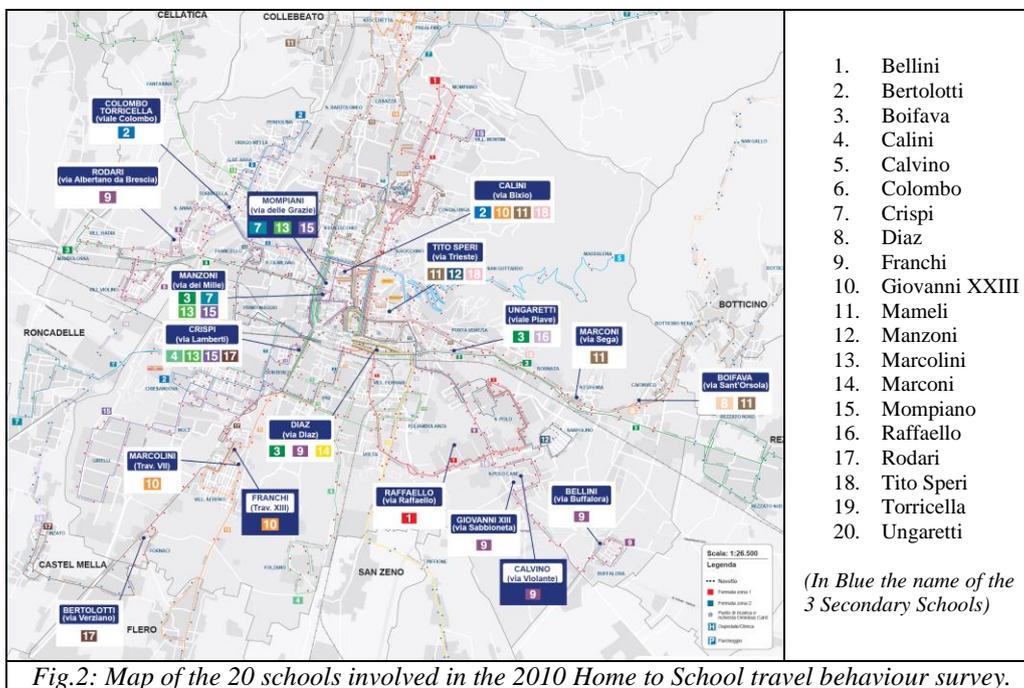


Fig.2: Map of the 20 schools involved in the 2010 Home to School travel behaviour survey.

### **Selected actions for schools**

The output of the surveys to schools made evidence of the difficulties in implementing coordinated actions for all the involved schools, as they have differences in locations and students typology. Therefore it was decided to carry out several experimental and demo activities in the schools such as:

- car pooling;
- pedibus,
- bikebus
- on demand school bus

Car-pooling experimentation is described in “Stage n.3: Experimentation of Car-pooling and Bike Tag”.

- **Stage 1a: Second Home to Work survey** (from April 2012 to October 2012) – This stage was an additional activity (out of the DOW scheduled ones) and consisted in a second survey

*campaign (which lasted from April to May 2012) addressed to companies. Respect to the survey to companies described in the “Stage 1: Survey campaigns for elaboration of the Home to Work/School Travel Plans”, the same questionnaire was administered and the same amount of companies were surveyed, in order to monitor any change in the travel behaviour of the interviewees and to update the Home to Work Travel Plans (either the aggregate one dedicated to 6 companies and the 15 single Plans).*

- **Stage 2: Training of the Mobility Managers** (from October 2009 to May 2012) – This stage consisted of different training activities addressed to the Mobility Managers nominated by the companies or schools involved in the survey described in the previous stage 1. These activities scheduled not only several educational seminars, but also some meetings organized in order to discuss the initiatives to be undertaken in the elaboration of the Travel Plans. The training phase was fundamental: as a matter of fact, often Mobility Managers aren't qualified technicians, but they are chosen among the employees. Therefore, the training activities made them able to act consciously on the elaborated surveys data and to propose potentially effective alternatives for mobility.

*The training course was structured in 3 modules for a total of 40 hours.*

*- In particular, during the first module (12 hours – October 2011) Mobility Managers were introduced to the sustainable mobility topic, to the study of people's transport habits and to the implemented survey methodology to define the "Home to Work/School Travel Plan".*

*- In the second module (12 hours – February 2012) many topics were presented, such as the techniques for the data elaboration collected through the survey, the individuation of critical situations in the home/work/school journey and the communications channels to be used to better motivate people to care about sustainability in their journeys.*

*- In the last module (16 hours – April/May 2012) the experiences and suggestions about the design of the plans of journeys “home-work” for workers and “home-school” for students and teachers were presented.*

*This course involved a total number of 15 mobility managers, coming either from companies and schools.*

**Stage 3: Experimentation of Car-pooling and Bike Tag initiative** (from October 2009 to October 2012)

#### **Car-pooling experimentation**

*A promotional campaign (see fig. 3A) for the experimentation of the car-pooling service addressed to several companies and schools.*

*The car-pooling service was also promoted among the employees working at the Municipality of Brescia without any success. They received an internal staff communication informing them about the new service, foreseeing also incentives (identification of dedicated stop stalls, special fares for public transport tickets, facilities for bike sharing city service and score cards delivery, etc.),*

*Only one school (The Tridentina School) joined the initiative and it was considered as a starting point of a wider project (i.e. a demo activity) that aimed to make people more aware of the environment by reducing the individual traffic and to increase of the car occupancy in the daily systematic trips.*

*The external Local Private Company “AZ Mobility” was charged to manage this experimentation, which provided a car-pooling service based on:*

- free trial of the data logger,*
- installation of the devices on board (see fig. 3B)*
- the automatic composition of the crews),*

- the automatic calculation of the fares for each crew.

At the end of the experimental phase, in June 12th a press-conference was organized. People who joined the experimentation were invited and awarded by the Alderman. The main prizes consisted in discounts for the car insurance, coupons for family travels and tickets to watch a football match at the Brescia stadium.



Fig.3A: Car-pooling promotional posters



Fig.3B: Data logger device to be installed on board provided by the company AZ Mobility for the CAR-POOLING experimentation in Brescia

### **Bike-Tag initiative**

The “bike tag” initiative consisted in proposing a system for re-finding lost or theft bicycles. In case of theft, Police can use this national register to find out information about the vehicle and the owner, increasing the likelihood of finding the vehicle.

The the bike tag action was organised as following:

- “bike tag kit” (serial number for bikes - see fig. 4) was distributed trough bike shopkeepers, and during targeted events;
- the serial number should be posted on the bicycle frame;

- the bike owner should register this serial in the national database (accessing the website [www.easytag.it](http://www.easytag.it)), including also other relevant information for the vehicle identification.



Fig.4: The bike tag kit for cyclists

The Municipality of Brescia tried to increase the number of tagged bikes, purchasing 2500 tagging distributed to bike shopkeepers and during the main events organized in Brescia, such as the “European Sustainable Mobility Week” or the “Bike national day”, organized every year in May. Bike tag was also promoted through a targeting a booklet to inform citizens about the advantages of using bicycle, the anti-theft systems and the solutions offered by the city of Brescia for the cycle mobility.

## B5 Inter-relationships with other measures

The measure is related to other measures as follows:

- **Measure 1 no. M.04.01** – “Mobility marketing”
- **Measure 2 no. M.04.03** – “Communication and educational campaigns”

The inter-relationships with these measures were given by the common objective to integrate the efforts to promote alternative solutions for the urban sustainable mobility.

Specific main indicators were set in order to specifically measure the impact of action carried out within this measure.

## C. Evaluation – methodology and results

From the evaluation point of view, the main objective of the measure consisted in promoting Mobility Actions in Brescia, focusing on the Car-pooling service experimentation, on the Home to Work Travel surveys and on the bike tag initiative.

## C1 Measurement methodology

The indicators were divided into two macro-categories: main indicators and complementary indicators. Main indicators were able to evaluate the measure efficiency in terms of objectives achievement. Complementary indicators were introduced in order to assess specific issues: namely, the travel behaviour of a representative sample of employees. These latter indicators were relevant only at local level and were used to give additional information in order to better understand the measure performance.

### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1.	Operating Revenues	Average operating revenues in car-pooling	Data provided by the service operator. As this measure was also object of CBA, it was possible to extract other useful information concerning the economic assessment of the initiative directly from the CBA itself	Main Indicator No ex ante data collection foreseen. First data collection after the o.p.: January 2012
2.	Operating Costs	Average operating costs in car-pooling	Data provided by the service operator. As this measure was also object of CBA, it was possible to extract other useful information concerning the economic assessment of the initiative directly from the CBA itself	Main Indicator No ex ante data collection foreseen. First data collection after the o.p.: January 2012
3.	Economy	N of "car-pooling" users / CBS investment	number of organized trip-crew and the total number of involved people divided by the cost incurred by the municipality for the car-pooling experimentation. As this measure was also object of CBA, it was possible to extract other useful information concerning the economic assessment of the initiative directly from the CBA itself	Main Indicator No ex ante data collection foreseen. First data collection after the o.p.: January 2012
4.	Fuel Consumption	Vehicle Fuel Efficiency	Estimated energy consumption per unit of transport activity	Complementary indicator First data collection after the o.p.: June 2012
5.	Emissions	CO <sub>2</sub> emissions	This indicator can be calculated using data coming from PSCS/L survey and looking to TREMOVE methodology	Complementary indicator First data collection after the o.p.: June 2012
6.	Vehicle Occupancy	Average vehicles occupancy in car-pooling	Data come from the PSCS/L survey. Persons who use car-pooling per vehicle	Complementary indicator First data collection after the o.p.: June 2012
7.	Vehicle Occupancy	Average Occupancy	average vehicle occupancy of the vehicles usually used by the employees (not necessarily those who use car-pooling service).	Complementary indicator First data collection after the o.p.: June 2012
8.	Modal split	Average modal split- trips	Kind of vehicles used for the Home-Work and Home-School travels	Complementary Indicator First data collection after the o.p.: June 2012

9.	Transport	Type of property cars used in HW trip /100 employees	“Type of property cars” refers to the kind of fuel used by the employees’ cars.	Complementary indicator First data collection after the o.p.: June 2012
10.	Transport	Type mopeds and motorcycles used in HW trip /100 employees	It’s considered the percentage of motorcycles/mopeds in H/W trips.	Complementary indicator First data collection after the o.p.: June 2012
11.	Transport	Type of property cars used in HW trip /100 employees in the peak hours	“Type of property cars” refers to the kind of fuel used by the employees’ cars.	Complementary indicator First data collection after the o.p.: June 2012
12.	Transport	N of car-pooling users /100 Car-pooling potential users	Number of the car-pooling users*100/total number of potential users Experimentation, promoted by Brescia Municipality in schools.	Main Indicator First data collection after the o.p.: June 2012
13.	Awareness	Awareness Level	Data from a specific questionnaire	Main Indicator First data collection after the o.p.: June 2012
14.	Acceptance	Acceptance Level	Data from a specific questionnaire	Main Indicator First data collection after the o.p.: April 2011
15.	Society	% of tagged bicycles per year during CIVITAS	Data come from the italian bicycle register	Main Indicator First data collection after the o.p.: April 2011

- **Indicator 1 (AVERAGE OPERATING REVENUES IN CAR-POOLING)** – This indicator concerns the car-pooling experimentation, managed by the Private Local Company “AZ Mobility”. The indicator is referred to the company revenues for the experimentation of the car-pooling service.
- **Indicator 2 (AVERAGE OPERATING COSTS IN CAR-POOLING)** – This indicator concerns the car-pooling experimentation, managed by the Private Local Company “AZ Mobility”. The indicator is referred to costs incurred by AZ Mobility for the experimentation of the CAR-POOLING service in Brescia.
- **Indicator 3 (N OF “CAR-POOLING” USERS / CBS INVESTMENT)** – This indicator concerned car-pooling experimentation, performed at the Tridentina school. It was collected as a confrontation between the number of organized trip-crews during the experimental phase (namely the total number of involved people) divided by the cost incurred by the Municipality for the car-pooling project.
- **Indicator 4 (VEHICLE FUEL EFFICIENCY)** – This indicator was defined as the energy consumption per unit of transport activity. It was possible to extract required data from the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies.
- **Indicator 5 (CO<sub>2</sub> EMISSIONS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. The indicator provides an estimation of the CO<sub>2</sub> produced by the trips generated by the employees involved in the survey. The adopted methodology was based on TREMOVE tables.
- **Indicator 6 (AVERAGE VEHICLES OCCUPANCY IN CAR-POOLING)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. It was possible to extract the number of people who usually share their car. It was important to underline that this indicator

wasn't referred to the car-pooling experimentation proposed by Municipality of Brescia, but it monitored the spontaneous car-pooling among the employees.

- **Indicator 7 (AVERAGE OCCUPANCY)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. This indicator represented the average number of passenger per vehicle and per trip. It was referred to the average vehicle occupancy of the vehicles usually made by the employees (who not necessarily share their car).
- **Indicator 8 (AVERAGE MODAL SPLIT-TRIPS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. It collected the means of transport daily used for the Home-Work trips.
- **Indicator 9 (TYPE OF PROPERTY CARS USED IN HW TRIP /100 EMPLOYEES)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. “Type of property cars” referred to the kind of fuel used by the employees’ cars. This indicator was expressed as percentage respect to the total number of property used cars.
- **Indicator 10 (TYPE MOPEDS AND MOTORCYCLES USED IN HW TRIP /100 EMPLOYEES)** - The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies.
- **Indicator 11 (TYPE OF PROPERTY CARS USED IN HW TRIP /100 EMPLOYEES IN THE PEAK HOURS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. A data cross was made between the usual travel hour of the employees and the respective kind of car used, focusing on the movements during the peak hour
- **Indicator 12 (N OF CAR-POOLING USERS/100 POTENTIAL USERS)** – This indicator concerned car-pooling experimentation, performed at the Tridentina school.
- **Indicator 13 (AWARENESS LEVEL)** – This indicator is referred to the awareness level of the population respect to the bike tag initiative. It was expressed by the percentage of people who had knowledge of a specific aspect respect to the total number of people who answered to the questionnaire. The specific question of the questionnaire was: *“Do you know the possibility of providing your bicycle with an univocal code and with a dedicated stick on tag, which allows, in case of theft, to increase the possibilities to find it?”*
- **Indicator 14 (ACCEPTANCE LEVEL)** – In the same questionnaire used for the indicator n. 13 a specific question about the level of acceptance of the Car-pooling service in Brescia. The indicator was expressed by the percentage of people who was interested in Car-pooling service, respect to the total number of people who answered the questionnaire. The specific question of the questionnaire was: *“A way to reduce traffic is to share home-work movement with other people (Car-pooling principle). Would you be disposed towards doing it, knowing that on one hand there’s the opportunity of halve tip costs with vehicle , on the other hand of use privileges at work/study place (reserved parking, ect.)?”*
- **Indicator 15 (N OF TAGGED BICYCLES PER YEAR DURING CIVITAS)** – Using data coming from the Easy tag national bike register, it was possible to extract the number of registered bike per year in Brescia. It was also possible to extract some useful information from the same questionnaire administered for the data collection of the previous indicators 13 and 14, elaborating the answers given to the specific question about the possibility to tag bikes. In particular, the administered question was: *“Do you know that it’s possible to tag your bike with a specific univocal code that would increase the possibility to retrieve it in case of theft?”*

## C1.2 Establishing a Baseline

The main Mobility Manager actions performed by this measure consisted in promoting several initiatives, such as the experimentation of the Car-pooling service, the bike tag initiative and the home to work travel surveys among the main companies located in Brescia.

The indicators, selected to evaluate the measure, were divided into 3 thematic areas, according to the aspects to assess:

- indicators which evaluated the experimentation of the Car-pooling in Brescia (indicator 1 “Average operating revenues in car-pooling”, indicator 2 “ Average operating costs in car-pooling”, indicator 3 N of “car-pooling” users / company investment”, indicator 12 “N of car-pooling users /100 Car-pooling potential users “, indicator14 “Acceptance Level of the Car-pooling service”);
- indicators which evaluated the bike tag initiative in Brescia (indicator 13 “Awareness level about bike tag initiative”, indicator 15 “N of tagged bicycles per year during CIVITAS”);
- indicators calculated basing on data coming from the home-work journeys (PSCL) surveys among the main companies located in Brescia. They were able to evaluate general aspects concerning the mobility of the employees working in the involved companies, in terms of modal split, pollutant gas emissions, travel behaviours, etc. (indicator 4 “Vehicle Fuel Efficiency”, indicator 5 “CO2 emissions”, indicator 6 “Average vehicles occupancy in car-pooling”, indicator 7 “Average Occupancy” indicator 8 “Average modal split - trips”, indicator 9 “Type of property cars used in HW trip”, indicator 10 “% of mopeds and motorcycles used in HW trip”, indicator 11 “Type of property cars used in HW trip in the peak hours”).

### Car pooling experimentation

Before the beginning of Civitas project, any experimentation of the Car-pooling service was ever made in Brescia. At the most “Car-pooling” was spontaneously practiced by citizens. Thanks to the participation to the Civitas project for the first time it was possible to experiment a car-pooling service managed by an external company, which provided the data logger and the software to automatically calculate the car-pooling crews and the fares. Therefore, the indicators selected to evaluate the car pooling service experimentation (indicators 1 “Average operating revenues in car-pooling”, 2 “Average operating costs in car-pooling”, 3 “N of “car-pooling” users / company investment”, 12 “N of car-pooling users/100 Car-pooling potential users”, 14 “Acceptance Level of the car pooling service”) had no Baseline value (as a matter of fact, they didn’t schedule an ex ante data collection).

Indicators concerning the Car-pooling service	BASELINE
1. Average operating revenues in car-pooling	0 (no service)
2. Average operating costs in car-pooling	0 (no service)
3. N of “car-pooling” users/company investment	0 (no service)
12. N of car-pooling users/100 Car-pooling potential users	0 (no service)
14. Acceptance Level of the Car-pooling service	0 (no service)
<i>Tab.1: Indicators 1, 2, 3 and 4 baseline</i>	

### Bike tag initiative

Indicators which evaluated the bike tag initiative promoted in Brescia during Civitas were n. 13 “Awareness level about bike tag initiative” and 15 “N of tagged bicycles per year during CIVITAS”. The year taken as reference for the Baseline situation was 2009 for the ind. 15 (using data provided by

the national tagged bike register) and March 2010 for indicator 13, that was calculated, administering a specific questionnaire to a sample of citizens living in Brescia.

Indicators concerning the Bike tag initiative	BASELINE
13. Awareness level about bike tag initiative (dedicated questionnaire March 2010)	20%
15. N of tagged bicycles per year during CIVITAS (2009)	2.341
<i>Tab.2: Indicators 13 and 15 baseline</i>	

### Home to Work surveys

As regards the indicators selected to evaluate in general the mobility behaviours of the employees working in the main companies located in Brescia, the year taken as reference for the Baseline was 2010, when the first Home to work survey about the travel behaviour was made.

Indicators concerning the mobility behaviours of the employees working in the main companies involved in the PSCL survey	BASELINE (2010)																						
4. Vehicle Fuel Efficiency	Gasoline non catalytic = 2,8 MJ/vkm Gasoline catalytic = 2,2 MJ/vkm Gasoil = 2,2 MJ/vkm GPL/Methane gas = 8,15 MJ/vkm Electric = 540 MJ/vkm																						
5. CO <sub>2</sub> emissions	Estimation of the CO <sub>2</sub> emissions generated by gasoline and gasoil powered vehicles = 8.147 kgCO <sub>2</sub>																						
6. Average vehicles occupancy in car-pooling	<b>2,15</b> person per shared vehicle (spontaneous car-pooling)																						
7. Average Occupancy	<b>1,27</b> person per vehicle																						
8. Average modal split - trips	<table border="1"> <thead> <tr> <th>Modal split</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>On foot</td> <td>2,83%</td> </tr> <tr> <td>Other</td> <td>0,06%</td> </tr> <tr> <td>Car</td> <td>81,48%</td> </tr> <tr> <td>Bicycle</td> <td>2,65%</td> </tr> <tr> <td>Bus</td> <td>2,83%</td> </tr> <tr> <td>Intermodal</td> <td>6,14%</td> </tr> <tr> <td>Motor bike/ Moped</td> <td>2,60%</td> </tr> <tr> <td>Not Answered</td> <td>1,24%</td> </tr> <tr> <td>Train</td> <td>0,18%</td> </tr> <tr> <td>Total</td> <td>100,00%</td> </tr> </tbody> </table>	Modal split	Total	On foot	2,83%	Other	0,06%	Car	81,48%	Bicycle	2,65%	Bus	2,83%	Intermodal	6,14%	Motor bike/ Moped	2,60%	Not Answered	1,24%	Train	0,18%	Total	100,00%
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Electric	0,1%																						
Total	100,0%																						
10. % of mopeds and motorcycles used in HW trip	The percentage of motorcycles/mopeds is 2,6% and they are all gasoline-powered.																						

11. Type of property cars used in HW trip in the peak hours	<b>fuel type</b>	% cars traveling during the peak hour
	No-catalytic gasoline	4,2%
	Catalytic gasoline	51,8%
	Gasoil	34,4%
	LPG/Methane gas	9,4%
	Electric	0,2%
	<b>Total</b>	<b>100,0%</b>

*Tab.3: Indicators 4, 5, 6, 7, 6,7, 8, 9, 10 and 11 baseline*

### C1.3 Building the Business-as-Usual scenario

#### Car pooling experimentation

Coherently with the fact that in Brescia the Car-pooling service didn't exist before Civitas and that probably without the Civitas contribution the service wouldn't even be experimented, the BaU scenario for the indicators concerning the car-pooling service equalled 0, as shown in the table below.

<b>Indicators concerning the Car-pooling service</b>	<b>BaU</b>
1. Average operating revenues in car-pooling	0 (no service)
2. Average operating costs in car-pooling	0 (no service)
3. N of "car-pooling" users/company investment	0 (no service)
12. N of car-pooling users/100 Car-pooling potential users	0 (no service)
14. Acceptance Level of the Car-pooling service	0 (no service)

*Tab.4: Indicators 1, 2, 3, 12, and 14 BaU*

#### Bike tag initiative

As regards the indicators concerning the bike tag initiative, without the Civitas contribution, probably its promotion wouldn't be improved. Therefore the BaU scenario, which had a time horizon set in year 2012, was built as follows: indicator 13 (Awareness level about bike tag initiative) had no historical data series, as it derived from a questionnaire administered *ad hoc*. Therefore, it would likely be equal to the baseline value. For Indicator 15 (N of tagged bicycles per year during CIVITAS) some historical data (2007-2009) were collected, but the available series wasn't sufficient for a reliable statistical projection. Therefore, the average increment of the number of tagged bikes was calculated in order to obtain the BaU value referred to year 2012 (as shown in the table reported below).

<b>Year</b>	<b>Registered bikes</b>	<b>Increment respect to the previous year</b>
2007	1026	-
2008	1577	+ 53%
2009	2341	+ 48 %

*Tab.5: Number of bike tagged per year (2007-2009)*

From table n. 5 it's possible to notice that the increment respect to the previous year decreased by 5% from 2008 to 2009. Assuming this trend as the same for the following years, the number of tagged bikes in 2012 was estimated as reported in the table below.

<b>Year</b>	<b>Increment respect to the previous year (estimation)</b>	<b>Registered bike (estimation)</b>
2010	+ 43%	3537

2011	+ 38%	5343
2012	+ 33%	8072
<i>Tab.6: Indicator 15 BaU (2010-2012)</i>		

Therefore, the BaU values for indicators which evaluated the bike tag initiative in Brescia were:

Indicators concerning the Bike tag initiative	BaU (2012)
13 Awareness level about bike tag initiative	20%
15 N of tagged bicycles per year during CIVITAS (estimation)	8072
<i>Tab.7: Indicator 13 and 15 BaU</i>	

### Home to Work surveys

As regards the indicators selected to evaluate the mobility behaviours of the employees of the companies involved in the Home to Work survey, it must be underlined that they were defined “complementary”, as they weren’t able to express the mobility patterns that characterized Brescia and didn’t evaluate the effective measure performance. The BaU scenario building had the time horizon set in year 2012, corresponding to the end of Civitas project when the metrobus wasn’t active yet (the start up of the metro line in Brescia was foreseen by 2013). The actions promoted by the Mobility Management had no tangible effects in the short term period, therefore it was possible to assume that the BaU values for these indicators didn’t change respect to the Baseline ones. At the most, at city level, the great success of the bike sharing service could likely increase the number of people who chose to move by bike.

Indicators concerning the mobility behaviours of the employees working in the main companies involved in the PSCL survey	BaU (2012)																						
4. Vehicle Fuel Efficiency	Gasoline non catalytic = 2,8 MJ/vkm Benzina catalytic = 2,2 MJ/vkm Gasoil = 2,2 MJ/vkm GPL/Methan gas = 8,15 MJ/vkm Electric = 540 MJ/vkm																						
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		Electric	0,1%
		<b>Total</b>	<b>100,0%</b>
10. % of mopeds and motorcycles used in HW trip	The percentage of motorcycles/mopeds is 2,6% and they are all gasoline-powered.		
11. Type of property cars used in HW trip in the peak hours		<b>fuel type</b>	<b>% cars traveling during the peak hour</b>
		No-catalytic gasoline	4,2%
		Catalytic gasoline	51,8%
		Gasoil	34,4%
		LPG/Methane gas	9,4%
		Electric	0,2%
		<b>Total</b>	<b>100,0%</b>
<i>Tab.8: Indicators 4, 5, 6, 7, 6,7, 8, 9, 10 and 11 BaU</i>			

## C2 Measure results

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

### C2.1 Economy

**Table C2.1.1: Measure results for the indicators corresponding to area “Economy”**

Indicator	Before	B-a-U	After	Difference: After – Before	Difference: After – B-a-U
1) Average operating revenues in car-pooling	Not scheduled ex-ante data collection	0 (no service) (year 2010)	€ 19.950,00 (year 2010)	€ 19.950,00	€ 19.950,00
2) Average operating costs in car-pooling	Not scheduled ex-ante data collection	0 (no service) (year 2010)	€ 42.167,00 (year 2010)	€ 42.167,00	€ 42.167,00
3) N of “car-pooling” users / CBS investment	Not scheduled ex-ante data collection	0 (no service)	12/ € 19.950	12/ € 19.950	12/ € 19.950

From the economic point of view, the service was free for users, therefore the company, which managed the service, partially covered its costs with the revenues coming from the Brescia Municipality investment.

The promotion of the car-pooling experimentation was addressed to the main companies and schools located in Brescia, but only one school joined the experimentation. Therefore as this three indicators were collected during the car-pooling service experimentation (which lasted from November 2010 to June 2011) it is not possible to assess the success of the car-pooling initiative in Brescia from the economic point of view.

As this measure is also object of a CBA, it is possible to extract proper information concerning the economic assessment of the initiative directly from the CBA.

However it's possible to make qualitative comments on the un-success of the demo activity: the data logger (i.e. the technical solution selected to manage the car-pooling service) wasn't much appreciated as the data logger wasn't seen as a user friendly system, it could be stolen from the car with consequent problem of potential claim of vehicle damages.

## C2.2 Energy

**Table C2.2.1: Measure results for the indicators of the category “Energy”**

Indicator	Before (survey 2010)	B-a-U (2012)	After (survey 2012)	Difference: After – Before	Difference: After – B-a-U			
4) Vehicle Fuel Efficiency	<b>fuel type</b>	<b>Indicator 4 [MJ/vkm]</b>	<b>fuel type</b>	<b>Indicator 4 [MJ/vkm]</b>	<b>fuel type</b>	<b>Δ [MJ/vkm]</b>	<b>fuel type</b>	<b>Δ [MJ/vkm]</b>
	Gasoline non catalytic	2,8	Gasoline non catalytic	2,8	Gasoline non catalytic	0	Gasoline non catalytic	0
	Benzina catalytic	2,2	Benzina catalytic	2,2	Benzina catalytic	0	Benzina catalytic	0
	Gasoil	2,2	Gasoil	2,2	Gasoil	0	Gasoil	0
	GPL/Methan gas	8,13	GPL/Methan gas	8,13	GPL/Methan gas	0	GPL/Methan gas	0
	Electric	5,4	Electric	5,4	Electric	0	Electric	0

Indicator n. 4 “Vehicle Fuel Efficiency” was calculated using the results of to the Home to Work Travel surveys, therefore it wasn’t representative of the whole city but it monitored the efficiency of the vehicles used during the H/W trips of the interviewed employees. The difference between the before and the after situation is negligible (almost 0).

The mobility management actions promoted by the measure didn’t affect the vehicle fuel efficiency, as Local Plans implementation by the companies produced a too slight effect on the territory. This is evident also from a little change in modal split (see section C.2.4).

## C2.3 Environment

**Table C2.3.1: Measure results for the indicators of the category “Environment”**

Indicator	Before (survey 2010)	B-a-U (2012)	After (survey 2012)	Difference: After – Before	Difference: After – B-a-U

Indicator	Before (survey 2010)	B-a-U (2012)	After (survey 2012)	Difference: After – Before	Difference: After – B-a-U
5) CO <sub>2</sub> emissions	Total CO <sub>2</sub> emissions generated by gasoline and gasoil powered vehicles = 8.147 kgCO <sub>2</sub>	Estimation of the CO <sub>2</sub> emissions generated by gasoline and gasoil powered vehicles = 8.147 kgCO <sub>2</sub>	Estimation of the CO <sub>2</sub> emissions generated by gasoline and gasoil powered vehicles = 9042,8 kgCO <sub>2</sub>	+ 895,8 kgCO <sub>2</sub>	+ 895,8 kgCO <sub>2</sub>

Indicator n. 5 “CO<sub>2</sub> emissions” was calculated using the results of the Home to Work Travel surveys. As already said for the previous indicator it wasn't representative of the whole city but it monitored the emissions produced by the vehicles used during the H/W trips of the interviewed employees.

The increasing trend observed between the 2010 survey and the 2012 one (+ 895,8 kgCO<sub>2</sub>) was just due to the higher number of filled in questionnaires, even if the same number of companies was involved: as the indicator was calculated basing on parametric estimation of the CO<sub>2</sub> emission, a higher number of filled in questionnaires corresponded to a higher amount of kms declared by the interviewees, then to higher emissions levels.

The mobility management actions promoted by the measure didn't affect CO<sub>2</sub>, as Local Plans implementation by the companies produced a too slight effect on the territory. This is evident also from a little change in modal split (see section C.2.4).

## C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category “Transport”**

Indicator	Before	B-a-U (2012)	After	Difference: After – Before	Difference: After – B-a-U
6) Average vehicles occupancy in (spontaneous) car-pooling* *This indicator is not referred to the car-pooling experimentation proposed by Municipality of Brescia, but is referred to a spontaneous car-	(survey 2010) 2,15 people per shared vehicle	2,15 person per shared vehicle (spontaneous car-pooling)	(survey 2012) 2,28 people per shared vehicle (spontaneous car-pooling)	+ 0,13	+ 0,13

Indicator	Before	B-a-U (2012)	After	Difference: After – Before	Difference: After – B-a-U
pooling					
7) Average Occupancy	(survey 2010) 1,27 person per vehicle	1,27 person per vehicle	(survey 2012) 1,23 person per vehicle	- 0.04	- 0.04
8) Average modal split-trips	(survey 2010)	<b>Modal split</b>	(survey 2012)	<b>Modal split</b>	<b>Difference (%)</b>
		<b>Total</b>		<b>Total</b>	<b>Difference (%)</b>
	On foot	2,83%	On foot	4,18%	- 1,35 %
	Other	0,06%	Other	0,06%	+ 0,00%
	Car	81,48%	Car	83,03%	+ 1,55%
	Bicycle	2,65%	Bicycle	4,15%	+ 1,50%
	Bus	2,83%	Bus	5,57%	+ 2,74
	Intermodal	6,14%	Intermodal	0,00%	-6,14%
	Motor bike/ Moped	2,60%	Motor bike/ Moped	2,24%	- 0,36%
	Not Answered	1,24%	Not Answered	0,00%	- 1,24%
	Train	0,18%	Train	0,76%	+ 0,58%
	Total	100,00%	Total	100,00%	

Indicator	Before	B-a-U (2012)	After	Difference: After – Before		Difference: After – B-a-U																																																																
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Indicator	Before	B-a-U (2012)	After	Difference: After – Before	Difference: After – B-a-U	
11) Type of property cars used in HW trip/100 employees in the peak hours	(survey 2010)		(survey 2012)			
	<b>fuel type</b>	% cars traveling during the peak hour	<b>fuel type</b>	% cars traveling during the peak hour	<b>fuel type</b>	% cars traveling during the peak hour
	No-catalytic gasoline	4,2%	No-catalytic gasoline	4,2%	No-catalytic gasoline	+ 9,3%
	Catalytic gasoline	51,8%	Catalytic gasoline	51,8%	Catalytic gasoline	-7,6%
	Gasoil	34,4%	Gasoil	34,4%	Gasoil	-5,9
	LPG/Methane gas	9,4%	LPG/Methane gas	9,4%	LPG/Methane gas	+4,2
	Electric	0,2%	Electric	0,2%	Electric	-0,05%
	<b>Total</b>	100,0%	<b>Total</b>	100,0%		
				<b>Total</b>	100,00%	

The indicators reported above were made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns,

As regards indicators n. 6 “Average vehicles occupancy in (spontaneous) car-pooling” and 7 “Average Occupancy”, according to the answers provided by the interviewees, the number of people driving alone increased (the average occupancy went from 1,27 in 2010 to 1,23 in 2012), but, at the same time, the people who shared their car (making a spontaneous car-pooling) carried a higher number of people during the home to work trips (the average occupancy in car-pooling went from 2,15 in 2010 to 2,28 in 2012).

Indicator n. 8 expressed the “modal split” characterizing the home-to-work trips. For this indicator the following result was obtained: the number of people using LPT and non-motorized means of transport (train, urban and extra-urban busses, bicycle, pedestrian mode) significantly increased (from 8,49% of people using these means of transport in 2010 to 14,66% in 2012), notwithstanding the slight increase registered by the use of cars. The use of powered two wheels (also monitored through the indicator n. 10 “mopeds and motorcycles used in HW trip/100 employees”) decreased (from 2,60% in 2010 to 2,24% in 2012).

Jointly observing the results obtained for indicators n. 9 “Type of property cars used in HW trip/100 employees” and 11 “Type of property cars used in HW trip/100 employees in the peak hours” an increasing number of methane gas powered vehicles was observed.

The positive results in terms of switch toward more “sustainable” means of transport cannot be associated only to the Mobility Management actions performed by the measure. The general period of economic crisis experienced in Italy favoured the collective transport solutions and cheaper fuel vehicle powering.

The following indicator n. 12 “N of car-pooling users/100 potential car-pooling users” concerned car-pooling service experimentation, performed at the Tridentina school.

Indicator	Before	B-a-U (2012)	After	Difference: After – Before	Difference: After – B-a-U
12) N of car-pooling users/100 potential car-pooling users	Not scheduled ex-ante data collection.	(2011) 0 (no service)	(2011) 2,73	Not assessable	+ 2,73

As regards indicator n. 12 “N of car-pooling users/100 potential car-pooling users”, which was referred to the car-pooling experimentation at the Tridentina School, it was possible to make the same consideration reported for the economic indicators (see “C2.1 Economy” subheading): the scarce success of the experimentation was probably due to the selected solution to manage the car-pooling service.

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category “Society”**

The following indicator n.14 “Acceptance Level” underlines that in Brescia there is a potential interest in car-pooling. This attitude should be better investigated in order to find out a suitable technical solution to organize crews and to manage car pooling actions.

Indicator	Before	After	B-a-U	Difference: After –Before	Difference: After – B-a-U
-----------	--------	-------	-------	------------------------------	------------------------------

Measure title:

**MOBILITY MANAGEMENT ACTIONS IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **04.06**

Indicator	Before	After	B-a-U	Difference: After –Before	Difference: After – B-a-U
14) Acceptance Level	Ex ante data collection not scheduled	March 2010: Acceptance level of the Car-pooling service: 13%	March 2010: 0 (no service)	Not Assessable	+13%
		April 2011: Acceptance level of the Car-pooling service: 9%	April 2011: 0 (no service)	Not Assessable	+9%
		April 2012: Acceptance level of the Car-pooling service: 14%	April 2012: 0 (no service)	Not Assessable	+14%

The following indicator n.13 “Awareness level”, n. 15 “N of tagged bicycles per year during CIVITAS” were selected to monitor the success of the bike tag initiative.

Indicator	Before	After	B-a-U	Difference: After –Before	Difference: After – B-a-U
13) Awareness Level	March 2010: Awareness level about bike tag initiative: 20%	April 2011: Awareness level about bike tag initiative: 35%	April 2011: Awareness level about bike tag initiative: 20%	+15%	+15%
		April 2012: Awareness level about bike tag initiative: 39%	April 2012: Awareness level about bike tag initiative: 20%	+19%	+19%
15) N of tagged bicycles per year during CIVITAS	year 2009: 2341	year 2010 2854	year 2010: 3537	+513	- 1196
		year 2011: 3156	year 2011: 5343	+815	- 2187
		year 2012 (until the end of May 2012): 3168	year 2012 (until the end of May 2012): 6480	+827	-3678

*Measure title:* **MOBILITY MANAGEMENT ACTIONS IN BRESCIA**

*City:* **Brescia**

*Project:* **MODERN**

*Measure number:* **04.06**

The increasing levels of awareness toward the initiative registered during Civitas and the slight increase of the tagged bike underlined the difficulties in promoting campaigns even if made during the most significant events organized in the city, such as the “European Sustainable Mobility Week” or the “bike national day”.

### Summary of the main CBA results (see Annex 3)

The following table shows the main results of the CBA made for this measure, which was made referring to the CAR-POOLING service experimentation of the Municipality of Brescia at the Tridentina School.

<b>COST/BENEFIT ANALYSIS</b>	<b>2025</b>
TOTAL KM RUNNING (km)	134.572
TOTAL KM SAVING (km)	291.502
INTEREST RATE	3,5%
NET PRESENT VALUE (€ 2010)	132
BENEFITS/COSTS RATIO	1,47
I.R.R.	3,6%

TABLE 9 – CBA results between Civitas Measure and Reference Measure/BaU (year 2025)

The initial investment cost for the Car-pooling experimentation (19.950 €) is re-paid in 15 years, thanks to the benefits associated to the emission and fuel saving, only if the total mileage covered by the car-pooling service will be 134'572 km.

This means that, the car-pooling experience in Brescia, which was characterized by an exiguous number of kms covered in 2011 during the experimentation (1.647 km), should increase the mileage covered by the car-pooling service yearly in the next 15 years by 21,5%, in order to register 25'169 kms in 2025 and to reach the cumulative value of 134'572 km (15 years).

As a matter of fact, only with this increasing rate, the Net Present Value and the Benefit/Costs Ratio become respectively higher than zero and higher than one in 15 years.

The Investment Return Rate in 2025 results 3,6%, practically equal to the estimated Interest Rate (3,5%).

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>To involve about 50% of the main companies located in Brescia (with more than 150 employees (corresponding to about 15 companies), including more companies than the ones who fitted with D.L.27 march 1998 on “Sustainable mobility”<sup>14</sup></p> <p><i>This objective was considered exceed.</i></p> <p><i>In occasion of the 2010 Home to Work Travel survey a total number of 25 joined the survey answering to about 1600 questionnaires.</i></p> <p><i>In occasion of the 2010 Home to School survey a total number of 20 schools joined the survey answering to about 2.300 questionnaires.</i></p>	***
2	<p>To elaborate Home to Work/School Travel Plans for each site</p> <p><i>This objective was considered substantially achieved.</i></p> <p><i>The 2010 Home to Work Travel survey to companies was used as basis for the elaboration of an aggregate Home to Work Travel Plan (as demo activity dedicated to a small sample of companies) and of 15 single Home to Work Travel Plans dedicated to each company. Instead of realizing Home to School Travel Plans, basing on the results coming from the Home to School survey, only specific actions were proposed, such as the Car-pooling service experimentation.</i></p>	*
3	<p>Car-pooling service experimentation avoiding about 150.000 km/year with 10 crews</p> <p><i>This objective was considered not achieved.</i></p> <p><i>During Civitas the car-pooling service was actually experimented, but the experimentation lasted only few months (from November 2010 to June 2011) and the crews were only 3. According to the CBA made for this measure, the mileage covered during the experimentation was 1.647 km, corresponding to about 3.569 km avoided at city level. These results weren't therefore considered significant respect to the original objective.</i></p> <p><i>The scarce success of the experimental initiative can be due to the solution selected to manage the car-pooling service: the installation of a data logger for the automatic composition of the crews and fares was perceived as a complicated system respect to a spontaneous car-pooling among colleagues.</i></p> <p><i>Indicator n. 12 (N of car-pooling users/100 potential car-pooling users) only 2,73 out of 100 potential users joined the experimentation at the Tridentina School</i></p> <p><i>Alongside this, the results of the Home to Work Travel surveys (one in 2010 and one in 2012) highlighted a quite consolidated attitude toward a spontaneous car-pooling among colleagues, even if characterized by a decreasing trend (see the information about the level of shared trips taken from the indicator n. 8 "Average modal split-trips"). At the same time, people who shared their car (making a spontaneous car-pooling) carried a higher number of people during the home to work trips, as it's possible to see from indicator n. 6 "Average</i></p>	0

<sup>14</sup> Decree Law 27 March 1998 which instituted the Mobility Manager profile for the Companies/Public Bodies with more than 300 employees.

	<p><i>occupancy in car-pooling”:</i></p> <p><i>Indicator n. 8 "Average modal split-trips"</i></p> <table border="0"> <tr> <td><i>Before situation (survey 2010)</i></td> <td><i>After situation (survey 2012)</i></td> </tr> <tr> <td><i>Shared car (driver): 5,55%</i></td> <td><i>Shared car (driver): 4,85%</i></td> </tr> <tr> <td><i>Shared car (passenger): 5,78%</i></td> <td><i>Shared car (passenger): 2,12%</i></td> </tr> <tr> <td><i>TOTAL 11,33%</i></td> <td><i>TOTAL 6,97%</i></td> </tr> </table> <p><i>Indicator n. 6 "Average vehicles occupancy in car-pooling"</i></p> <p><i>Before situation (survey 2010) = 2,15</i></p> <p><i>After situation (survey 2012) = 2,28</i></p>	<i>Before situation (survey 2010)</i>	<i>After situation (survey 2012)</i>	<i>Shared car (driver): 5,55%</i>	<i>Shared car (driver): 4,85%</i>	<i>Shared car (passenger): 5,78%</i>	<i>Shared car (passenger): 2,12%</i>	<i>TOTAL 11,33%</i>	<i>TOTAL 6,97%</i>	
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<i>Shared car (passenger): 5,78%</i>	<i>Shared car (passenger): 2,12%</i>									
<i>TOTAL 11,33%</i>	<i>TOTAL 6,97%</i>									
4	<p>Spread of the culture of sustainable mobility increasing public transport use for the home to work trips (+1%).</p> <p><i>This objective can be considered achieved.</i></p> <p><i>According to the Home to Work Travel surveys, which was made among a representative set of companies, an increasing number of people decided to use collective means of transport for their H/W trips, as it's possible to observe through the indicator n. 8 "Average modal split-trips".</i></p> <p><i>indicator n. 8 "Average modal split-trips":</i></p> <p><i>Before situation (survey 2010)</i></p> <p><i>LPT transport: 2,83% Train: 0,18% (Total = 3,01%)</i></p> <p><i>After situation (survey 2012)</i></p> <p><i>LPT transport: 5,57% Train: 0,76% (Total = 6,33%)</i></p> <p><i>Even if the objective of increasing public transport use for the home to work trips by +1% was more than achieved, it must be underlined that the positive results in terms of switch toward more "sustainable" means of transport cannot be associated only to the promotion activities of alternative means of transport performed by the measure. The general period of economic crisis experienced in Italy favoured the collective transport solutions and cheaper fuel vehicle powering.</i></p>	**								
5	<p>Increase of the number of tagged bicycles in Brescia, reaching 6000 tagged bicycles</p> <p><i>This objective was considered not achieved.</i></p> <p><i>As it's possible to observe from indicator n. 15 "N of tagged bicycles per year during CIVITAS", the number of tagged bike didn't reach the expected objective, notwithstanding an increasing trend.</i></p> <p><i>Ind. 15 "N of tagged bicycles per year during CIVITAS"</i></p> <p><i>Before situation (Year 2009): 2.341</i></p> <p><i>After situation (partial data up to May 2012): 3.168</i></p>	O								
6	<p>To involve about 20.000 people</p> <p><i>The activities carried out during the measure implementation and during targeted events such as the "European Sustainable Mobility Week" in Brescia involved all the city, therefore the objective can be considered achieved in full.</i></p>	**								
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b></p> <p><b>** = Achieved in full            *** = Exceeded</b></p>										

## C4 Up-scaling of results

Mobility management actions carried out by Brescia Municipality are usually opened to all the stakeholders (also according to the Italian law) of the city (companies, public bodies, citizens, etc.). It is up to them whether to join the initiatives or not.

The up scaling of the measure could consist in extending the elaboration of the Home to Work Plans to a wider set of companies (under 150 employees) located in Brescia in order to increase the impacts of the Mobility Management actions at city level.

## C5 Appraisal of evaluation approach

The evaluation activities consisted in the collection of the necessary data to calculate the selected indicators for the ex-ante/ex-post situation. The chosen set of indicators was subdivided into five categories: "Economy", "Energy", "Environment", "Transport" and "Society".

I was decided to monitor mobility management actions through Main and Complementary indicators as following:

### *Car pooling*

As regards the "Economy" category, indicators n. 1 "Average operating revenues in car-pooling", n. 2 "Average operating costs in car-pooling" and n. 3 "N of "car-pooling" users / CBS investment" were selected to assess the car-pooling service experimentation managed by the external company. These data were also useful for the CBA.

Indicator n. 12 "N of car-pooling users/100 potential car-pooling users" was collected in relation to the car-pooling experimentation carried out among schools in Brescia, promoted by the Municipality.

Finally, as regards the category "Society", the data related to acceptance level (indicator n. 14) was collected through specific questions in the questionnaire of the Municipality of Brescia about Civitas project activities.

### *Bike tagging*

category "Society" was used to monitor the awareness (indicator n. 13) of the initiative through specific questions in the questionnaire of the Municipality of Brescia about Civitas project activities. and the indicator 15 "N of tagged bicycles per year during CIVITAS" was chosen in order to monitor the bike tagging activities, already implemented in the city and strengthened during the Civitas project.

### *Home to Work surveys*

The indicators were selected in the categories "Energy" and "Environment". Indicators 4 "Vehicle Fuel Efficiency", 5 "CO2 emissions", 6 "Average vehicles occupancy in (spontaneous) car-pooling", 7 "Average Occupancy", 9 "Type of property cars used in HW trip /100 employees", 10 "Type mopeds and motorcycles used in HW trip /100 employees", 11 "Type of property cars used in HW trip /100 employees in the peak hours" were calculated basing on data coming from the home-work travels surveys to companies.

The indicators related to the pollutant emissions and to the fuel consumption were estimated through the REMOVE tables, as it was considered the more suitable methodology to be used. All these indicators allowed the evaluation of general aspects concerning the mobility of the interviewed employees, in terms of modal split, pollutant gas emissions, travel behaviours, etc. For this reason these indicators were defined "complementary" as they were not able to express the mobility patterns

that characterized all the city of Brescia (they were referred to a sample of companies) and didn't evaluate the effective measure performance.

## C6 Summary of evaluation results

Even if the objective of the measure weren't achieved in full, it was possible to highlight the following key results:

- **Key result 1** – As regards the evaluation activities, the second Home to Work Travel survey to companies allowed to make some interesting consideration in relation to the mobility habits of the involved companies: the positive results in terms of switch toward more “sustainable” means of transport cannot be associated only to the promotion activities of alternative means of transport performed by the measure. The general period of economic crisis experienced in Italy favoured the collective transport solutions and cheaper fuel vehicle powering.
- **Key result 2** – The experimentation of the car-pooling service was made according to the measure objectives, but recurring to the wrong technological solution. This can be considered the main reason of its substantial failure.
- **Key result 3** – At the end of Civitas the number of tagged bike didn't reach the expected objective, notwithstanding an increasing trend (+ 35% in 2012 respect to 2009);

## C7 Future activities relating to the measure

The future activities relating to the measure are here summarized:

- To keep the bike tagging initiative alive;
  - To update the 2012 Home to Work Travel Plans.
-

## D. Process Evaluation Findings

### D0 Focused measure

This measure was set as “focused” at the beginning of the Civitas project. The reasons of this choice are here reported:

1	The measure fitted into the city policy towards sustainable urban transport and/or towards sustainability in general
2	The high level of innovativeness of the measure with respect to technique, consortium, process, learning etc.
3	The interest in deepening a Cost Effective Analysis in relation to Car pooling action.

### D1 Deviations from the original plan

No significant deviations from the original plan were pointed out, except from the administration of an extra Home to Work Travel survey to companies in 2012 (the DOW included only the 2010 survey).

### D2 Barriers and drivers

#### D2.1 Barriers

Here the main barriers encountered during the measure implementation are reported:

##### Implementation phase

- **Organizational barrier** – In January 2011 the Measure Leader changed, therefore some problems were encountered in terms of measure activities reorganization;
- **Cultural barrier** – The behavioural change in the citizens life style patterns is a complicated issue and the mobility management actions aren't so able to significantly affect consolidated travel habits, especially in the short period.

##### Operational phase

- **Technological barrier** – The car-pooling service experimentation initiative didn't find rich soil among the involved potential users: the technological solution to manage the service proposed by the company AZ Mobility didn't please involved people. As a matter of fact, the installation on board of the data logger was perceived as a problem from the security point of view: the installation of visible devices on board could favour the thefts of the data logger itself, with consequent problem of potential claim of vehicle damages.

#### D2.2 Drivers

##### Implementation phase

- **Context driver** –The general period of economic crisis experienced in Italy generally favoured the collective transport solutions and cheaper fuel vehicle powering. Therefore, the positive results obtained during the measure implementation (in terms of switch toward more “sustainable” means of transport) cannot be associated only to the actions performed by the measure.

## D2.3 Activities

### Preparation phase

- **Communicational activity** – Meetings were arranged during the preparation phase of the surveys among the Municipality of Brescia and the companies/school representatives, in order to increase the success of the survey initiative.

### Operational phase

- **Communicational activity** – In order to involve as much people as possible in the activities promoted by the Municipality of Brescia (during the Home to Work/School surveys and also during the events organized) also “incentives” were introduced: for example, the participants to the mobility projects were awarded with prizes and special discounts.

## D3 Participation

### D.3.1 Measure partners

- **Municipality of Brescia** – the actions promoted by the measure were performed and coordinated by the Mobility Manager nominated by the Municipality of Brescia. Its role consisted in delivering and sharing sustainable mobility proposals to targeted stakeholders, in order to promote the modal shift towards more sustainable means of transport.
- **AZ Mobility** – the external Company which managed the experimentation of the car-pooling.

### D.3.2 Stakeholders

- **The involved Companies and their Mobility Managers** - They were involved during the two Home to Work Travel survey carried out by the Municipality of Brescia in 2010 and in 2012 to investigate the mobility habits of their employees and the activities. The survey activities were finalized to the elaboration of Home to Work Travel Plans, sharing the most suitable mobility actions with the companies themselves. Some of the Mobility Managers attended the training courses organized by the Municipality of Brescia.
- **The involved Schools and their Mobility Managers** - They were involved during the Home to School Travel survey carried out by the Municipality of Brescia in 2010 to investigate the mobility habits of students and their families. Schools were object of specific actions, such as the Car-Pooling experimentation. Some of the Mobility Managers attended the training courses organized by the Municipality of Brescia.

## D4 Recommendations

### D.4.1 Recommendations: measure replication

- **Use of the data logger** - The measure was devoted to mobility management actions, designed for and implemented in the specific reality. So, of course any kind of transferability is mainly methodological. No specific innovative methodology was used, as the analysis were performed using the current mobility management techniques. The innovative initiative was represented by the use of the on-board data logger for the collection of data about the use of car pooling by the crews. This technique could be transferrable, but unfortunately it wasn't a success. As a matter of fact, the installation of this device was perceived as a problem from the security point of view: the installation of visible devices on board could favour thefts, with consequent problem of potential claim for vehicle damages. Therefore, the car pooling scheme has to be managed in a different way.

### D.4.2 Recommendations: process

- **More targeted and widespread information** – The availability of mobility management actions, such as the economic incentives for the purchase of clean vehicles or the promotion of collective transport services, is particularly important in times of economic crisis, when people is more predisposed to change their mobility habits to more sustainable behaviours.
- **Other car-pooling solutions** – As regards the car-pooling implementation, the solution promoted by the Municipality of Brescia, based on the data logger installation on board, wasn't appreciated by the users. At the same time, a quite consolidated attitude toward more spontaneous way of car-pooling was observed in Brescia. Therefore, other solutions for the car-pooling initiative promotion should be found.
- **Involve bicycle Companies in the bike tag initiative** – The bike tag initiative didn't reach the expected success. This can be due to several reasons: the scarce effectiveness of the system itself or of the promotional activities. Anyway, it would be useful if the bicycle companies could impress the security code directly on the bicycles frame, instead of posting a sticker.

## Annex 1: Historical data series for the BaU calculation

### Indicator 15 (% OF TAGGED BICYCLES PER YEAR DURING CIVITAS)

Year	2007	2008	2009
Number of registered bikes in Brescia	1026	1577	2341

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1 (AVERAGE OPERATING REVENUES IN CAR-POOLING)** – This indicator concerns the car-pooling experimentation, managed by the Private Local Company “AZ Mobility”. The indicator is referred to the company revenues coming from the Municipality of Brescia for the experimentation of the car-pooling service.

As this measure is also object of a CBA, it will be possible to extract other useful information concerning the economic assessment of the initiative directly from the CBA itself.

### EX ANTE SITUATION

Not scheduled

### FIRST DATA COLLECTION

The first data collection was referred to the period 2009-2010, when the Municipality of Brescia gave its contribution to the Company AZ Mobility for the car-pooling service experimentation.

Ind.1 = € 19.950,00

- **Indicator 2 (AVERAGE OPERATING COSTS IN CAR-POOLING)** – This indicator concerns the car-pooling experimentation, managed by the Private Local Company “AZ Mobility”. The indicator is referred to costs incurred by the company for the experimentation of the car-pooling service in Brescia.

As this measure is also object of a CBA, it will be possible to extract other useful information concerning the economic assessment of the initiative directly from the CBA itself.

### EX ANTE SITUATION

Not scheduled

### FIRST DATA COLLECTION

The only data collection was made in January 2012, when the car-pooling experimentation could be considered finished (it lasted from November 2010 to June 2011). The costs incurred by Azmobility for the experimentation of the car-pooling service in Brescia included the purchase of the data logger, (the devices which had to be installed on the vehicles to automatically calculate the crews and the fares), but also to the dissemination campaigns for the car-pooling promotion and the technical assistance related to the devices and, in general, to all the operating costs.

Ind.2 = € 42.167,00

- **Indicator 3 (N OF “CAR-POOLING” USERS PER 100 EMPLOYEES / CBS INVESTMENT)**  
This indicator is collected as a confrontation between the number of organized trip-crew (namely, the total number of involved people) divided by the cost incurred by the Municipality for the car-pooling project.

No ex-ante is foreseen but only one data collection after the operation phase of the measure. This indicator concerns the car-pooling experimentation which involved the Tridentina school (from November 2010 to June 2011). 3 crews were formed, composed each by 1 driver and 4 children attending the Tridentina School. The number of car-pooling users to be used for the calculation

of the indicator is 4/crew: this is given by the number of transported children excluding the driver.

Crew 1 = 4 people

Crew 2 = 4 people

Crew 3 = 4 people

Total number of Car-pooling users = 12 people

Ind. 2 (January 2012) = 12/19.950,00 €

- **Indicator 4 (VEHICLE FUEL EFFICIENCY)** – This indicator was defined as the energy consumption per unit of transport activity. It was possible to extract the kind of fuel used by cars from the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies.

To calculate this indicator the “Guide for the fuel saving and about the CO<sub>2</sub> emissions”<sup>15</sup> was taken as reference. This Guide was released as regulation for the implementation of the European Directive 1999/94/CE<sup>16</sup> thanks to the collaboration among 3 Italian Government Departments: Ministero delle Attività Produttive, Ministero dell’Ambiente e della tutela del territorio and Ministero delle Infrastrutture e dei Trasporti (the picture below shows an extract of the tables that can be found in the Guide).

Casa costruttrice	Modello	Carrozzeria	Carburante	Cilindrata	Potenza Kw	Cambio	Emissioni CO <sub>2</sub> g/km	Consumi (l/100 km)		
								Urbano	Extra	Misto
ALFA ROMEO	ALFA 147 1.6 TS 16V 105 CV	3P / 5P	BENZINA	1598	77	M - 5	192	11,1	6,3	8,1
ALFA ROMEO	ALFA 147 1.6 TS 16V 120 CV	3P / 5P	BENZINA	1598	88	M - 5	194	11,2	6,4	8,2
ALFA ROMEO	ALFA 147 2.0 TS 16V	3P / 5P	BENZINA	1970	110	M - 5	211	12,1	7	8,9
ALFA ROMEO	ALFA 147 2.0 TS 16V SELESPEED	3P / 5P	BENZINA	1970	110	A - 5	211	12,1	7	8,9
ALFA ROMEO	ALFA 147 GTA 3.2 V6 24V	3P	BENZINA	3179	184	M - 6	287	18,1	8,6	12,1
ALFA ROMEO	ALFA 156 1.6 TS 16V	4P	BENZINA	1598	88	M - 5	195	11,4	6,4	8,2
ALFA ROMEO	ALFA 156 1.6 TS 16V DEPOTENZIATA	4P	BENZINA	1598	81	M - 5	195	11,4	6,4	8,2
ALFA ROMEO	ALFA 156 1.8 TS 16V	4P	BENZINA	1747	103	M - 5	202	12,1	6,4	8,5
ALFA ROMEO	ALFA 156 2.0 JTS	4P	BENZINA	1970	122	M - 5	205	12,2	6,6	8,6
ALFA ROMEO	ALFA 156 2.0 JTS SELESPEED	4P	BENZINA	1970	122	A - 5	205	12,2	6,6	8,6
ALFA ROMEO	ALFA 156 2.5 V6 24V	4P	BENZINA	2492	141	M - 6	282	17,5	8,5	11,8
ALFA ROMEO	ALFA 156 2.5 V6 24V Q SYSTEM	4P	BENZINA	2492	141	A - 4	283	17,5	8,6	11,9
ALFA ROMEO	ALFA 156 GTA 3.2 V6 24V	4P	BENZINA	3179	184	M - 6	287	18,1	8,6	12,1
ALFA ROMEO	ALFA 156 GTA 3.2 V6 24V SELESPEED	4P	BENZINA	3179	184	A - 6	287	18,1	8,6	12,1
ALFA ROMEO	ALFA 156 SPORTWAGON 1.6 TS 16V	5P	BENZINA	1598	88	M - 5	198	11,5	6,5	8,3
ALFA ROMEO	ALFA 156 SPORTWAGON 1.6 TS 16V DEPOTENZIATA	5P	BENZINA	1598	81	M - 5	198	11,5	6,5	8,3
ALFA ROMEO	ALFA 156 SPORTWAGON 1.8 TS 16V	5P	BENZINA	1747	103	M - 5	205	12,2	6,5	8,6
ALFA ROMEO	ALFA 156 SPORTWAGON 2.0 JTS	5P	BENZINA	1970	122	M - 5	212	12,5	6,8	8,9
ALFA ROMEO	ALFA 156 SPORTWAGON 2.0 JTS SELESPEED	5P	BENZINA	1970	122	A - 5	212	12,5	6,8	8,9
ALFA ROMEO	ALFA 156 SPORTWAGON 2.5 V6 24V	5P	BENZINA	2492	141	M - 6	286	17,8	8,6	12
ALFA ROMEO	ALFA 156 SPORTWAGON 2.5 V6 24V Q SYSTEM	5P	BENZINA	2492	141	A - 4	291	18,1	8,8	12,2
ALFA ROMEO	ALFA 156 SPORTWAGON GTA 3.2 V6 24V	5P	BENZINA	3179	184	M - 6	293	18,4	8,8	12,3
ALFA ROMEO	ALFA 156 SPORTWAGON GTA 3.2 V6 24V SELESPEED	5P	BENZINA	3179	184	A - 6	293	18,4	8,8	12,3
ALFA ROMEO	ALFA GT 2.0 JTS	2P	BENZINA	1970	122	M - 5	208	12,2	6,7	8,7
ALFA ROMEO	ALFA GT 2.0 JTS SELESPEED	2P	BENZINA	1970	122	A - 5	208	12,2	6,7	8,7
ALFA ROMEO	ALFA GT 3.2 V6 24V	2P	BENZINA	3179	176	M - 6	295	18,6	8,7	12,4
ALFA ROMEO	ALFA 166 2.0 TS 16V	4P	BENZINA	1970	110	M - 6	230	13,8	7,3	9,7
ALFA ROMEO	ALFA 166 2.5 V6 24V	4P	BENZINA	2492	138	M - 6	284	17,2	8,8	11,9
ALFA ROMEO	ALFA 166 3.0 V6 24V SPORTRONIC	4P	BENZINA	2959	162	A - 4	310	19,4	9,3	13
ALFA ROMEO	ALFA 166 3.2 V6 24V	4P	BENZINA	3179	176,5	M - 6	297	18,3	9,1	12,5
ALFA ROMEO	ALFA GTV 2.0 TS 16V	2P	BENZINA	1970	110	M - 5	220	13,3	6,8	9,2

For each kind of power supply, the average consumption per km was calculated. As we know the kms made for the Home-Work travel survey (from the questionnaire database) for each fuel category, it’s possible to estimate the total fuel consumption (l, m<sup>3</sup>, etc). Using the calorific power (specific for each kind of fuel) it’s possible to estimate the total energy consumption (MJ). The calculation of the indicator follows the formula:

<sup>15</sup> [http://www.consumieclima.org/download/guida\\_risparmio\\_carburante\\_emissionico2.pdf](http://www.consumieclima.org/download/guida_risparmio_carburante_emissionico2.pdf)

<sup>16</sup> DPR 17 febbraio 2003 n.84 “Regolamento di attuazione della direttiva n. 1999/94/CE

$$A = B/C$$

A = Average vehicle energy efficiency = [MJ/vkm]

B = Total energy consumed by the fleet = [MJ]

C = Total amount vehicle kms completed by the vehicles = [vkm]

### EX ANTE DATA COLLECTION (Home to Work survey made in 2010)

The indicator was obtained by the data collection linked to the questionnaires for the integrated home to work plan, which involved significantly about 12 companies.

The amount of energy consumption refers to the declarations about the kind of fuel reported in the questionnaires (question number D31). The total number of cars used for the home-work travel is 2.249. For the calculation of the total number of kms per vehicle (parameter C) the information contained in the database were taken as reference. It's important to notice that only 2.125 people answered to the question about the kms traveled by car (question number D25).

Using the Ministry methodology, each vehicle consumes the following amount of energy:

	N. of cars	fuel type and unit of measure	Km (One way trip)	km (round trip)	Average fuel consumption [l/100km m <sup>3</sup> /100km kWh/km]	Total amount of fuel [l m <sup>3</sup> kWh]	Calorific power [MJ/l MJ/m <sup>3</sup> MJ/kWh]	Energy consumption (MJ)	Indicator 4 [MJ/vkm]
	78	Gasoline non catalytic [l]	962	1924	9	173,16	31,5	5455	2,835
	1108	Benzina catalytic [l]	12501	25002	7	1750,14	31,5	55129	2,205
	828	Gasoil [l]	13711	27422	6,5	1782,43	34,235	61021	2,225
	233	GPL/Meth an gas [m <sup>3</sup> ]	3483	6966	13	905,58	62,545	56640	8,130
	2	Electric [kWh]	9	18	0,15	0,027	3600	97,20	5,400
<b>Totals</b>	<b>2249</b>		<b>30666</b>	<b>61332</b>				<b>187965</b>	

### EX POST DATA COLLECTION (June 2012)

The ex post data collection was made in occasion of the second survey campaign made by the Municipality of Brescia in 2012, in order to review the Home to Work Travel Plans. Following the methodology described for the ex ante data collection, the ex post of the indicator n. 4 was calculated as follows:

	N. of cars	fuel type and unit of measure	Km (One way trip)	km (round trip)	Average fuel consumption [l/100km m <sup>3</sup> /100km kWh/km]	Total amount of fuel [l m <sup>3</sup> kWh]	Calorific power [MJ/l MJ/m <sup>3</sup> MJ/kWh]	Energy consumption (MJ)	Indicator 4 [MJ/vkm]
	438	Gasoline non catalytic [l]	5347	10694	9	962,46	31,5	30317	2,835
	1079	Benzina catalytic [l]	15448	30896	7	2162,72	31,5	68126	2,205
	742	Gasoil [l]	14036	28072	6,5	1824,68	34,235	62468	2,225
	334	GPL/Methan gas [m <sup>3</sup> ]	5154	10308	13	1340,04	62,545	83813	8,131
	2	Electric [kWh]	9	18	0,15	0,027	3600	97	5,400
<b>Totals</b>	2595		39994	79988				244821	

- **Indicator 5 (CO<sub>2</sub> EMISSIONS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to companies. The indicator provides an estimation of the CO<sub>2</sub> produced by the trips generated by the employees involved in the survey. The adopted methodology was based on TREMOVE tables. Its application was suitable because the information contained in the questionnaires provided the information on the immatriculation years. Therefore, deriving the “EURO” label from it<sup>17</sup>, it was possible to estimate the CO<sub>2</sub> emissions using TREMOVE tables.

#### EX ANTE DATA COLLECTION (Home to Work survey made in 2010)

Before the calculation of the indicator some clarifications are necessary:

Number of filled in questionnaires: 2596

Number of people who answered “type of car supply”: 2249

Of which we know the “matriculation year”: 1919

Of which we know both the “matriculation year” and the “travelled km in the HW travel: 1697

Therefore, the total km calculated for this indicator is different from the total ones calculated for the Indicator n.4 (Indicator n.4 vkm = 61.332, as you can see in the following table).

Label	Number of gasoline powered cars	Number of gasoil powered cars	vkm Gasoline powered (one way trip)	vkm Gasoil powered (one way trip)	vkm Gasoline powered (round trip)	vkm Gasoil powered (round trip)
Euro 0	12	0	117	0	234	0
Euro 1	66	3	807	63	1614	126

<sup>17</sup> It's important to notice that the assignment of the EURO label to a vehicle is usually based not only by the registration year but also on the caption that can be found in the log book (CE directives adopted by the vehicle manufacturer). As we don't have at our disposal that paper, the attribution has been made basing only on the registration year.

Euro 2	276	101	2833	1589	5666	3178
Euro 3	390	347	4904	5301	9808	10602
Euro 4	220	236	2301	4325	4602	8650
Euro 5	22	24	283	583	566	1166
subtotals	986	711	11245	11861	22490	23722
<b>totals</b>	<b>1697 [cars]</b>		<b>23106 [vkm]</b>		<b>46212 [vkm]</b>	

Now that we know the number of vkm for each kind of EURO label and of fuel supply (only gasoline and gasoil vehicles), the following CO<sub>2</sub> emission factors (taken from the Tremove emissions tables) were taken into consideration:

Label	vkm Gasoline powered (round trip)	vkm Gasoil powered (round trip)	CO <sub>2</sub> emission factors for the gasoline-powered vehicles [g/vkm]	CO <sub>2</sub> emission factors for the gasoil-powered vehicles [g/vkm]	CO <sub>2</sub> emissions (gasoline-powered vehicles) [kgCO <sub>2</sub> ]	CO <sub>2</sub> emissions (gasoil-powered vehicles) [kgCO <sub>2</sub> ]
Euro 0	234	0	289,95	192,03	67,8	0,0
Euro 1	1614	126	202,21	203,87	326,4	25,7
Euro 2	5666	3178	194,48	190,72	1101,9	606,1
Euro 3	9808	10602	181,24	174,52	1777,6	1850,2
Euro 4	4602	8650	170,22	153,66	783,3	1329,2
Euro 5	566	1166	160,10	161,95	90,6	188,8
Subtotals	22490	23722			4147,7	4000,0
<b>Totals</b>	<b>46212 [vkm]</b>				<b>8147,7 [kg CO<sub>2</sub>]</b>	

It's important to remark that only gasoline and gasoil powered vehicles have been taken into consideration because Tremove tables only provide the respective emissions factors. Therefore the emissions generated by GPL/Methane gas powered vehicles are not included in the calculation of the indicator. The indicator is obtained by the data collection linked to the questionnaires for the integrated home to work plan, which has involved 12 companies.

#### EX POST DATA COLLECTION (Home to Work survey made in June 2012)

Before the calculation of the indicator the following clarification is necessary: the number of people who answered to "type of car supply", of which we know the "matriculation year" and the "travelled km in the H/W travel is 1692.

Label	Number of gasoline powered cars	Number of gasoil powered cars	vkm Gasoline powered (one way trip)	vkm Gasoil powered (one way trip)	vkm Gasoline powered (round trip)	vkm Gasoil powered (round trip)
Euro 0	3	2	52	17	104	34
Euro 1	14	1	197,1	8,5	394,2	17
Euro 2	141	29	1458,5	463,1	2917	926,2
Euro 3	346	219	4695	4186,5	9390	8373
Euro 4	353	231	5120,5	4281,8	10241	8563,6
Euro 5	211	142	2952,6	3122,3	5905,2	6244,6
subtotals	1068	624	14475,7	12079,2	28951,4	24158,4
<b>totals</b>	<b>1692 [cars]</b>		<b>26554,9 [vkm]</b>		<b>53109,8 [vkm]</b>	

Now that we know the number of vkm for each kind of EURO label and of fuel supply (only gasoline and gasoil vehicles), the following CO<sub>2</sub> emission factors (taken from Tremove tables) have been taken into consideration for the Indicator n.5:

Label	vkm Gasoline powered (round trip)	vkm Gasoil powered (round trip)	CO <sub>2</sub> emission factors for the gasoline-powered vehicles [g/vkm]	CO <sub>2</sub> emission factors for the gasoil-powered vehicles [g/vkm]	CO <sub>2</sub> emissions (gasoline-powered vehicles) [kgCO <sub>2</sub> ]	CO <sub>2</sub> emissions (gasoil-powered vehicles) [kgCO <sub>2</sub> ]
Euro 0	104	34	289,95	192,03	30,2	6,5
Euro 1	394,2	17	202,21	203,87	79,7	3,5
Euro 2	2917	926,2	194,48	190,72	567,3	176,6
Euro 3	9390	8373	181,24	174,52	1701,8	1461,3
Euro 4	10241	8563,6	170,22	153,66	1743,2	1315,9
Euro 5	5905,2	6244,6	160,1	161,95	945,4	1011,3
Subtotals	28951,4	24158,4			5067,7	3975,1
<b>Totals</b>	<b>53109,8 [vkm]</b>				<b>9042,8 [kg CO<sub>2</sub>]</b>	

It's important to remark that only gasoline and gasoil powered vehicles have been taken into consideration because Tremove tables only provide the respective emissions factors. Therefore the emissions generated by GPL/Methane gas powered vehicles are not included in the calculation of the indicator. The indicator is obtained by the data collection linked to the questionnaires for the integrated home to work plan, which has involved 12 companies.

- **Indicator 6 (AVERAGE VEHICLES OCCUPANCY IN CAR-POOLING)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns. It collected the number of people who share their car. It was important to underline that this indicator wasn't referred to the car-pooling experimentation proposed by Municipality of Brescia, but it monitored the spontaneous car-pooling among the employees.

#### EX ANTE DATA COLLECTION (Home to Work survey made in 2010)

According to the results of the survey, the total number of people who spontaneously share their car is **544**. The average vehicle occupancy, considering their declarations, is **2,15** person per shared vehicle.

#### EX POST DATA COLLECTION (Home to Work survey made in June 2012)

According to this second survey, the total number of people who, before the starting of the official service experimentation, share their car is **554**. The average vehicle occupancy, considering their declarations, is **2,28** person per shared vehicle.

- **Indicator 7 (AVERAGE OCCUPANCY)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to campaigns. This indicator represented the average number of passenger per vehicle and per trip. It was referred to the average vehicle occupancy of the vehicles usually made by the employees (who not necessarily share their car)

#### EX ANTE DATA COLLECTION (Home to Work survey made in 2010)

Using data coming from the answers to the question number D21 of the questionnaire used in the survey, it's possible to obtain how many people use the car alone (**1769** people). Using data from

question number D34 (the same information used for the ex ante of the previous indicator) is possible to consider vehicle occupancy for those who share their car for the home-work trip (**544** people).

The average vehicle occupancy is therefore **1,27** people per vehicle.

**EX POST DATA COLLECTION (Home to Work survey made in June 2012)**

According to the methodology described above, the results of this second survey showed that the number of people who use the car alone is **2510**. the vehicle occupancy for those who share their car for the home-work trip (**554** people).

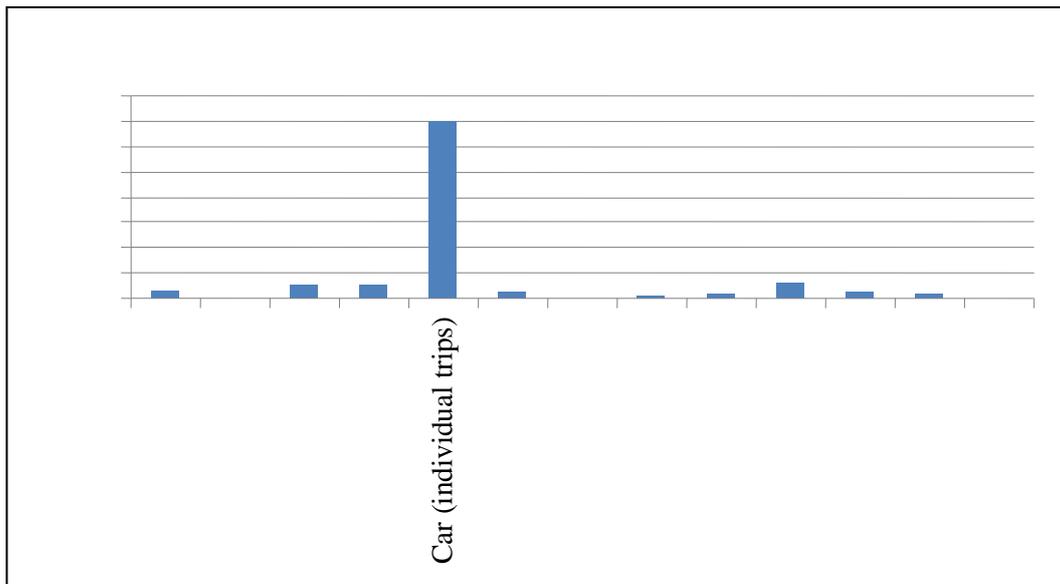
The average vehicle occupancy is therefore **1,23** people per vehicle.

- **Indicator 8 (AVERAGE MODAL SPLIT-TRIPS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to compaigns. It collected the means of transport daily used for the Home-Work trips.

**EX ANTE DATA COLLECTION (Home to Work survey made in 2010)**

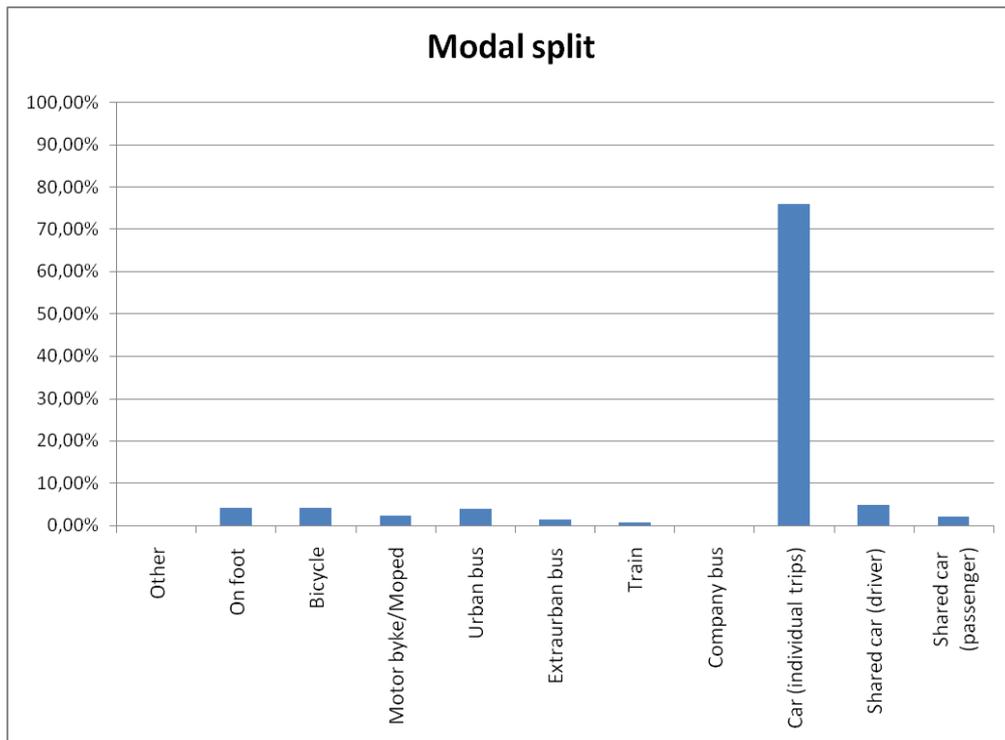
According to the survey results, data concerning the “use of car” derives from the sum of “shared cars (driver)”, “Shared car (passenger)” and “Car (individual trips)”. Likewise, the results for “use of bus” come from the sum of “Company bus”, “Extra-urban bus” and “Urban bus”.

Modal split	Partial	Total
On foot	2,83%	2,83%
Other	0,06%	0,06%
Shared car (driver)	5,55%	81,48%
Shared car (passenger)	5,78%	
Car (individual trips)	70,15%	
Bicycle	2,65%	2,65%
Company bus	0,06%	2,83%
Extra-urban bus	0,88%	
Urban bus	1,89%	
Intermodal	6,14%	6,14%
Motor bike/ Moped	2,60%	2,60%
Not Answered	1,24%	1,24%
Train	0,18%	0,18%
Total	100,00%	100,00%



**EX POST DATA COLLECTION (Home to Work survey made in June 2012)**

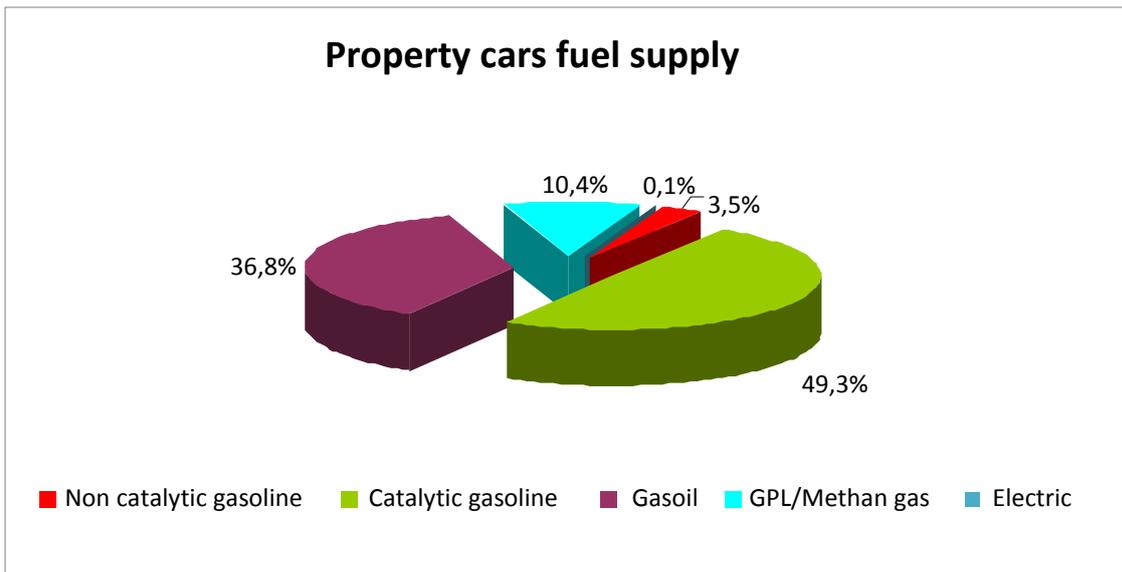
Modal split	Partial	Total
On foot	4,18%	4,18%
Other	0,06%	0,06%
Shared car (driver)	4,85%	83,03%
Shared car (passenger)	2,12%	
Car (individual trips)	76,06%	5,57%
Bicycle	4,15%	
Company bus	0,09%	
Extra-urban bus	1,48%	5,57%
Urban bus	4,00%	
Intermodal	0,00%	0,00%
Motor bike/ Moped	2,24%	2,24%
Not Answered	0,00%	0,00%
Train	0,76%	0,76%
Total	100,00%	100,00%



- Indicator 9 (TYPE OF PROPERTY CARS USED IN HW TRIP /100 EMPLOYEES) –**  
 The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns to compaigns. “Type of property cars” referred to the kind of fuel used by the employees’ cars. This indicator was expressed as percentage respect to the total number of property used cars.

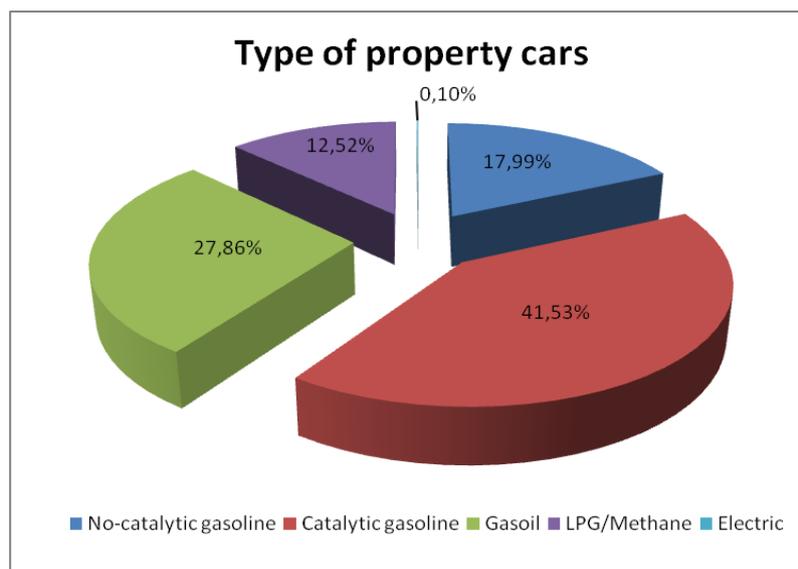
**EX ANTE DATA COLLECTION (Home to Work survey made in 2010)**

Type of property cars	Absolute values	Percentage respect to the total amount of property cars
No-catalytic gasoline	78	3,5%
Catalytic gasoline	1109	49,3%
Gasoil	828	36,8%
LPG/Methane	233	10,4%
Electric	2	0,1%
<b>Total</b>	<b>2250</b>	<b>100,0%</b>



**EX POST DATA COLLECTION (Home to Work survey made in June 2012)**

Type of property cars	Absolute values	Percentage respect to the total amount of property cars
No-catalytic gasoline	516	21,9%
Catalytic gasoline	1191	50,6%
Gasoil	799	34,0%
LPG/Methane	359	15,3%
Electric	3	0,1%
<b>Total</b>	<b>2352</b>	<b>100,0%</b>



- **Indicator 10** (TYPE MOPEDS AND MOTORCYCLES USED IN HW TRIP /100 EMPLOYEES) – The calculation of this indicator was made using data provided by the

questionnaire distributed to the employees during the Home to Work travel survey campaigns to campaigns. From the distributed questionnaires it was not possible to extract the kind of fuel used by motorcycles/moped (usually they are gasoline-powered).

#### **EX ANTE DATA COLLECTION (Home to Work survey made in 2010)**

Using the modal split coming from the PSCL survey (See indicator n. 8) the percentage of people using mopeds/motorcycles for their travel is **2,6%**. The indicator is obtained by the data collection linked to the questionnaires for the integrated home to work plan, which has involved 12 companies.

#### **EX POST DATA COLLECTION (Home to Work survey made in June 2012)**

Using the modal split coming from the PSCL survey (See indicator n. 8) the percentage of people using mopeds/motorcycles for their travel is **2,24%**. The indicator is obtained by the data collection linked to the questionnaires for the integrated home to work plan, which has involved 12 companies.

- **Indicator 11 (TYPE OF PROPERTY CARS USED IN HW TRIP /100 EMPLOYEES IN THE PEAK HOURS)** – The calculation of this indicator was made using data provided by the questionnaire distributed to the employees during the Home to Work travel survey campaigns. A data cross was made between the usual travel hour of the employees and the respective kind of car used, focusing on the movements during the peak hour (from 7:30 and 8:30 in the morning)

#### **EX ANTE DATA COLLECTION (Home to Work survey made in 2010)**

fuel type	N. cars traveling during the peak hour	%. cars traveling during the peak hour
No-catalytic gasoline	45	4,2%
Catalytic gasoline	561	51,8%
Gasoil	373	34,4%
LPG/Methane gas	102	9,4%
Electric	2	0,2%
<b>Total</b>	<b>1083</b>	<b>100,0%</b>

The indicator is obtained by the data collection linked to the questionnaires for the integrated home to work plan, which has involved 12 companies.

#### **EX POST DATA COLLECTION (Home to Work survey made in June 2012)**

fuel type	N. cars traveling during the peak hour	%. cars traveling during the peak hour
No-catalytic gasoline	100	13,51%
Catalytic gasoline	327	44,19%
Gasoil	211	28,51%
LPG/Methane gas	101	13,65%
Electric	1	0,14%
<b>Total</b>	<b>740</b>	<b>100,00%</b>

- **Indicator 12 (N OF CAR-POOLING USERS /POTENTIAL USERS)** – This indicator concerned car-pooling experimentation, performed by the Brescia Municipality at the Tridentina

school. It is calculated dividing the number of car-pooling users during the experimentation (A) and the potential number of car-pooling users (B), represented by the total number of students attending the involved school.

No ex-ante is foreseen but only one data collection after the operation phase of the measure (in **May 2011**). This indicator concerns the car-pooling experimentation which involved the Tridentina school (from November 2010 to June 2011). 3 crews were formed, composed each by 1 driver and 4 children attending the Tridentina School. The number of car-pooling users to be used for the calculation of the indicator is 4/crew: this is given by the number of transported children excluding the driver.

Crew 1 = 4 people

Crew 2 = 4 people

Crew 3 = 4 people

(A) Total number of Car-pooling users = 12 people;

(B) Total number of students attending the school (school year 2010/2011) = 439 children

$$\text{Indicator 12} = A \cdot 100 / B = 2,73$$

(\*) In order to estimate the car-pooling potential users, the total number of students has been considered, as each student is supposed to be carried to school by one parent.

- **Indicator 13 (AWARENESS LEVEL);** This indicator expresses the awareness level of the population toward the bike tag initiative promoted by the Municipality of Brescia. is measured through the administration of a questionnaire to the Brescia citizens. The questionnaire is the same used for the acquisition of indicators belonging to other CBS measures (M05.02, M06.05 and M04.06). As explained in the M05.02 Evaluation Results Template, a survey based on face to face interviews would have required more time than the scheduled, to collect a significant ex-ante before the implementation of the measure, a faster procedure (that slightly differs from the initial one) was chosen: the questionnaires were administered by phone by a charged company. The representative sample was chosen among the resident population (this choice was based on operative considerations: extending the survey also to the gravitating population would have introduced too many complications and would have incised the costs). The sample size, of 600 filled in questionnaires, was selected among the personal data of the Municipality (which allowed a statistical significance of more than the 90%).

**EX ANTE SITUATION** (Questionnaire administered in March 2010):

To reach the goal of 600 filled in questionnaires, the company in charge of the survey contacted 787 families. Only 220 of them answered to the phone calls but thanks to the fact that families are generally composed by more than one members, are collected totally **601 filled in questionnaires**. The questionnaires have been administered **from 5<sup>th</sup> February to 3<sup>rd</sup> March 2010**. This period can be considered as a valid ex ante for this measure.

The questions included in the questionnaire, able to express the indicator “Awareness level” is the following:

*“Do you know that it’s possible to tag your bike (registering it into a National Register) in order to increase, in case of theft, the possibilities to find it?” The possible answers are: 1. Yes, but my bike hasn’t been tagged yet; 2. Yes and my bike has already been tagged; 3. Yes but I’m not interested/Don’t think it would be useful; 4. No but I’m interested; 5. No and I’m not interested.*

The awareness level of the population respect to the bike tag initiative.

- Awareness level about bike tag initiative:

Yes, but my bike hasn’t been tagged yet	15,00%	20,00%
---	--------	--------

Yes and my bike has already been tagged	2,50%	
Yes but I'm not interested/Don't think it would be useful	2,50%	
No but I'm interested	47,50%	
No and I'm not interested	32,50%	
Total	100,00%	

**AFTER SITUATION: (Questionnaire of April 2011)**

- Awareness level about bike tag initiative:

Yes, but my bike hasn't been tagged yet	16,00%	
Yes and my bike has already been tagged	11,00%	
Yes but I'm not interested/Don't think it would be useful	8,00%	
No but I'm interested	30,00%	
No and I'm not interested	35,00%	
Total	100,00 %	

**AFTER SITUATION: (Questionnaire of April 2012)**

- Awareness level about bike tag initiative:

Yes, but my bike hasn't been tagged yet	22,00	
Yes and my bike has already been tagged	5,00	
Yes but I'm not interested/Don't think it would be useful	12,00	
No but I'm interested	28,00	
No and I'm not interested	33,00	
Total	100,00 %	

- Indicator 14 (ACCEPTANCE LEVEL)** – This indicator expresses the acceptance level of the population toward a Car-pooling service in Brescia.

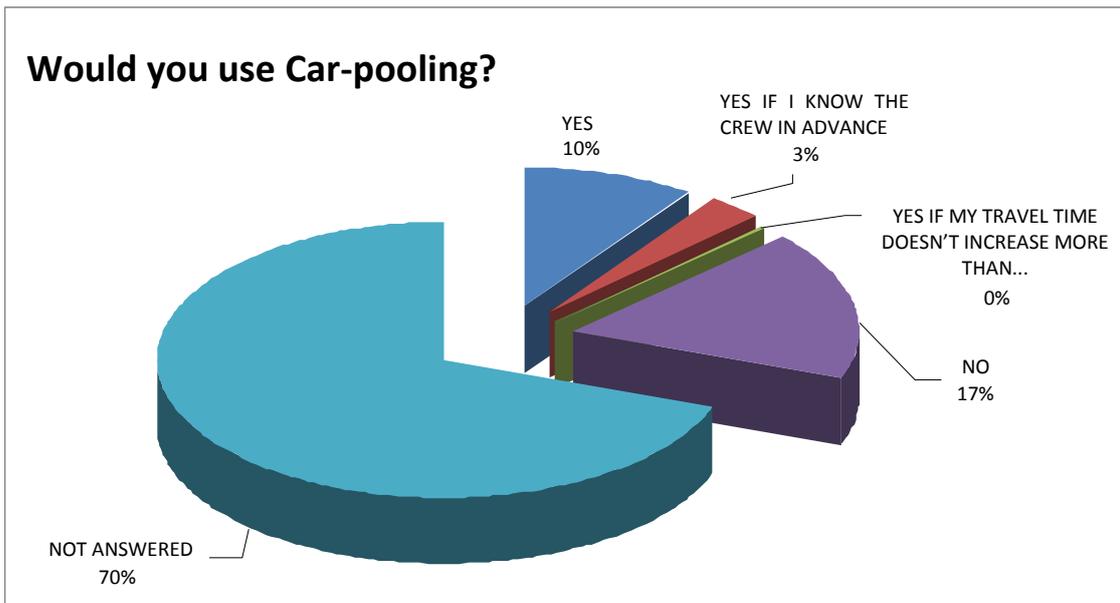
The indicator was calculated through the administration of a questionnaire to the Brescia citizens. Some questions about car-pooling service were inserted in the questionnaires elaborated for the measures 05.02 and 05.03. The methodological aspects and the timing of the data collection concerning this survey are the same described for the previous indicator n. 13 “Awareness level”.

According to the specific topic investigated, the March 2010 survey represented the first data collection, as it's not possible to have an ex ante situation for a service that in Brescia wasn't active.

**FIRST DATA COLLECTION (March 2010)**

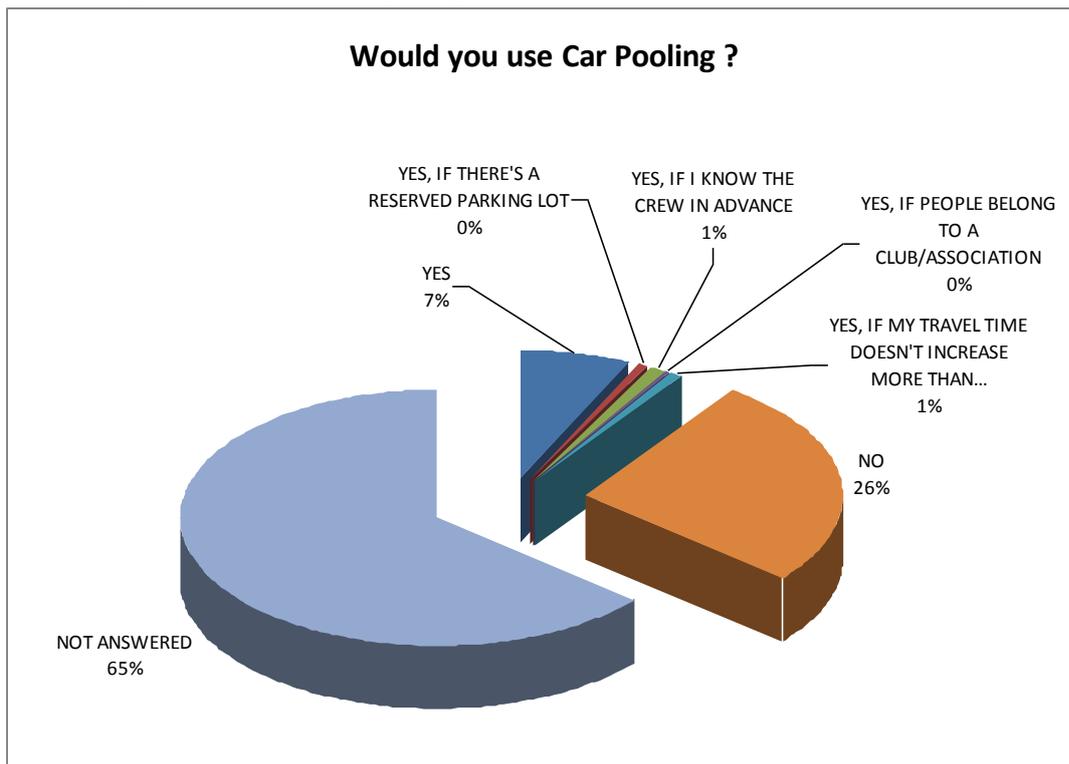
**Results elaboration:** To reach the goal of 600 filled in questionnaires, the company contacted 787 families. Only 220 of them answered to the phone calls but thanks to the fact that families are generally composed by more than one members, has been collected totally **601 filled in questionnaires**. The questionnaires were administered **from 5<sup>th</sup> February to 3<sup>rd</sup> March 2010**. The Acceptance level indicator is composed by the acceptance level of the population toward the Car-pooling service.

- Acceptance level about Car-pooling: **10%+3% +0%= 13%**



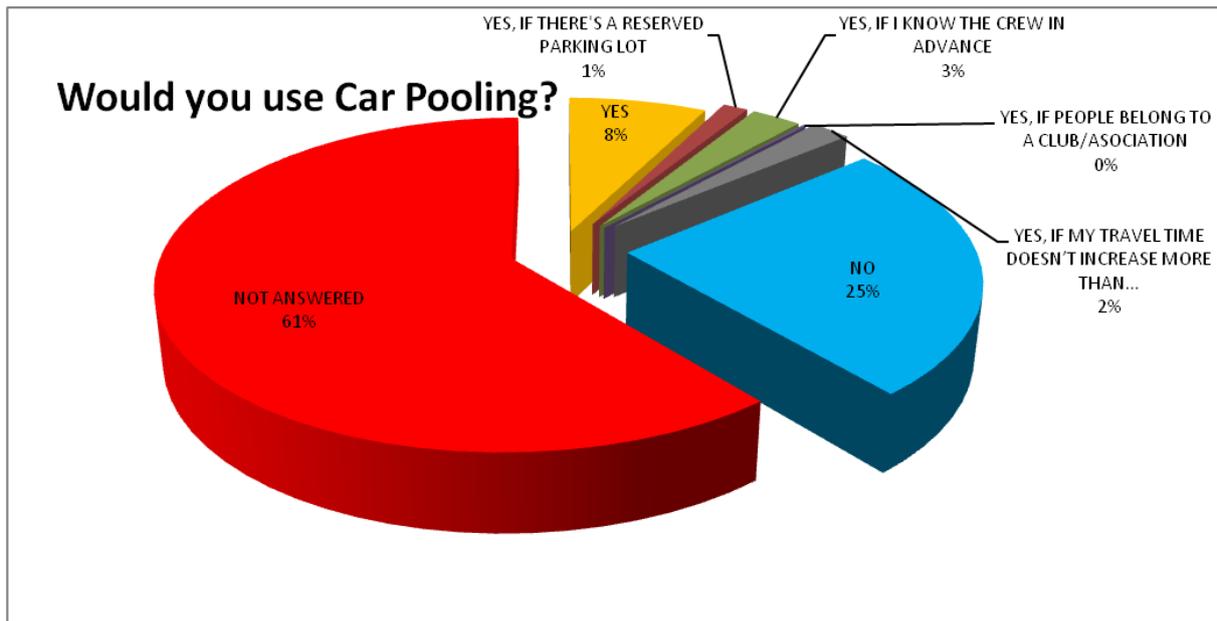
**SECOND DATA COLLECTION (April 2011) :**

- Acceptance level about Car-pooling:  $7\% + 0\% + 1\% + 0\% + 1\% = 9\%$



**THIRD DATA COLLECTION (April 2012) :**

- Acceptance level about Car-pooling:  $8\% + 1\% + 3\% + 0\% + 2\% = 14\%$



The questionnaire is reported below (in red the specific section of the questionnaire dedicated to car-pooling):



**Comune di Brescia**  
**Settore Mobilità e Traffico**  
**Assessorato alla Mobilità e Traffico**



THE CIVITAS INITIATIVE  
IS CO-FINANCED BY THE  
EUROPEAN UNION

**INDAGINE “CIVITAS PLUS”**  
**sul livello di conoscenza dei progetti**  
**“Centro di Monitoraggio per la sicurezza stradale”, “Miglioramento**  
**della sicurezza per i ciclisti”, “Car sharing” e “Car pooling”**

**Scheda familiare**  
**Anno 2009**

**Informazioni sull'indagine**

Il Comune di Brescia è coinvolto, dall'ottobre 2008, in un programma europeo chiamato Civitas Plus Modern. Tale programma riunisce in un consorzio 4 città europee (Brescia, Vitoria Gasteiz, Craiova e Coimbra) impegnate nell'implementazione di progetti che mirano alla mobilità sostenibile, alla riduzione dell'inquinamento e alla sicurezza. Le misure cofinanziate dalla Comunità Europea e portate avanti dalla città di Brescia sono in totale 14 e conseguono gli obiettivi del programma europeo agendo su fronti diversi: si stanno portando avanti progetti che vanno dalla promozione dell'uso di carburanti alternativi e mezzi ad elevata efficienza energetica allo sviluppo di sistemi integrati di bigliettazione del trasporto pubblico, dall'organizzazione di campagne informative allo studio di soluzioni innovative per gli spostamenti casa/lavoro o per le merci in città, dalla pianificazione della sicurezza stradale allo sviluppo di sistemi innovativi per la gestione della domanda per il trasporto pubblico.

Per i sotto progetti riguardanti il Centro di Monitoraggio per la sicurezza stradale, il miglioramento della sicurezza per i ciclisti, il Car Sharing e il Car pooling, gestiti dal Comune Di Brescia, è prevista, mediante indagini campionarie presso la popolazione residente, un'attività periodica di monitoraggio per valutare il livello di conoscenza dei progetti da parte della cittadinanza.

Il presente questionario raccoglie informazioni anche su aspetti demografici e sociali della famiglia intervistata, ma la scheda è anonima e la sua compilazione è facoltativa e lasciata alla disponibilità e collaborazione delle famiglie.

**Ringraziamo le famiglie rispondenti e tutte le persone coinvolte nella rilevazione per la collaborazione.**

**Codice Famiglia**

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**Codice rilevatore**

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**Data di consegna**

		/			/				
--	--	---	--	--	---	--	--	--	--

**Numero di componenti**

--

**Circoscrizione di residenza**

--

**Quartiere di residenza**

--

**Componente 1**

Relazione di parentela	<input type="checkbox"/> 1 Intestatario scheda anagrafica			
Sesso	<input type="checkbox"/> F <input type="checkbox"/> M	Anno di nascita		
Stato civile	<input type="checkbox"/> 1 Nubile/celibe	<input type="checkbox"/> 2 Coniugata/o	<input type="checkbox"/> 3 Separata/o Divorziata/o	<input type="checkbox"/> 4 Vedova/o
Titolo di studio	<input type="checkbox"/> 1 Nessuno	<input type="checkbox"/> 2 Licenza elementare	<input type="checkbox"/> 3 Diploma media inferiore	
	<input type="checkbox"/> 4 Diploma media superiore o professionale		<input type="checkbox"/> 5 Laurea	
Condizione professionale	<input type="checkbox"/> 1 Occupato	<input type="checkbox"/> 2 Disoccupato/in cerca di lavoro		<input type="checkbox"/> 3 Casalinga
	<input type="checkbox"/> 4 Ritirato dal lavoro	<input type="checkbox"/> 5 Studente		<input type="checkbox"/> 6 Altro

Qual'è il principale mezzo di trasporto che utilizza abitualmente per...	Tragitto casa/lavoro o casa/scuola	Spese, commissioni, accesso ai servizi	Tempo libero	Altri spostamenti
Piedi	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1
Bicicletta	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2
Ciclomotore	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3
Automobile	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Trasporto pubblico	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5

Prima di essere contattato per questa indagine, era a conoscenza del Progetto Civitas Plus per la mobilità sostenibile, pulita e sicura?  Sì  No

**SICUREZZA STRADALE:**

Lei è a conoscenza di campagne informative (realizzate nelle scuole, in città, ecc) sul tema degli incidenti stradali?  Sì  No

Se sì, può precisare tramite quali mezzi di comunicazione? (Scelta multipla)

Cartelloni pubblicitari	<input type="checkbox"/>
Volantini o brochures	<input type="checkbox"/>
TV locali	<input type="checkbox"/>
Stampa	<input type="checkbox"/>
Siti web	<input type="checkbox"/>
Radio	<input type="checkbox"/>
Altro	<input type="checkbox"/>

Specificare "altro"

Solo per i maggiori di 14 anni:  
 Considera prioritario il problema dell'incidentalità?  Sì  No

Quale grado di priorità attribuirebbe ad interventi intrapresi al fine di risolvere tale problema?  Alto  Medio  Basso

Tra le cause di incidente prevalenti riportate qui di seguito, qual è quella che le desta più preoccupazione?

Infrazioni semaforiche	<input type="checkbox"/>
Eccesso di velocità	<input type="checkbox"/>
Mancato rispetto di stop/precedenza	<input type="checkbox"/>
Mancato rispetto della distanza di sicurezza	<input type="checkbox"/>
Manovre/attraversamenti/svolte irregolari	<input type="checkbox"/>
Sosta vietata agli incroci o presso gli attraversamenti pedonali	<input type="checkbox"/>
Stato psico-fisico alterato	<input type="checkbox"/>
Altro	<input type="checkbox"/>

Specificare "altro"

E' a conoscenza del fatto che il Comune, attraverso il progetto Civitas Plus, intende dotarsi di un Piano della Sicurezza Stradale Urbano (PSSU) proprio per cercare di risolvere il problema dell'incidentalità stradale?  Sì  No

Quali sono le categorie di utenti della strada da favorire nell'ambito di una pianificazione della sicurezza stradale? Potrebbe fornire un ordine di priorità?

Automobilisti	<input type="checkbox"/>
Pedoni	<input type="checkbox"/>
Ciclisti	<input type="checkbox"/>
Motociclisti e ciclomotoristi	<input type="checkbox"/>
Autobus	<input type="checkbox"/>

**BICICLETTA:**

Negli ultimi 6 mesi, ha utilizzato la bicicletta?  Si  No

*Prosegue la compilazione solo chi ha risposto Si al quesito precedente:*

Negli ultimi 6 mesi, ha utilizzato le piste ciclabili?  Si  No

Ritiene che i percorsi ciclabili, siano sufficientemente segnalati e riconoscibili?  Si  No

Conosce e ha utilizzato la mappa dei percorsi ciclabili cittadini?

Non sapevo dell'esistenza della mappa dei percorsi ciclabili	<input type="checkbox"/>
Conosco la mappa, ma non l'ho mai usata	<input type="checkbox"/>
Conosco la mappa e l'ho utilizzata saltuariamente	<input type="checkbox"/>
Conosco la mappa e la utilizzo spesso	<input type="checkbox"/>

Come giudica la dotazione di rastrelliere per biciclette in città nei luoghi da lei frequentati?

Inadeguata	<input type="checkbox"/>
Adeguate	<input type="checkbox"/>
Eccessiva	<input type="checkbox"/>

E' a conoscenza del fatto che il Comune, attraverso il progetto Civitas, intende dotare tutti i percorsi ciclabili cittadini di un'apposita segnaletica di direzione, nonché rinnovare e migliorare la segnaletica orizzontale e verticale esistente ed incrementare il numero delle rastrelliere in città?  Si  No

Conosce la possibilità di dotare la sua bicicletta di un codice univoco e di un'apposita targhetta adesiva che consenta, in caso di furto, di aumentare la possibilità di ritrovamento?

Si, ma la mia bicicletta non è ancora dotata di targa	<input type="checkbox"/>
Si e la mia bicicletta è già dotata di targa	<input type="checkbox"/>
Si, ma non mi interessa/non credo sia efficace	<input type="checkbox"/>
No, ma mi interessa	<input type="checkbox"/>
No, non mi interessa	<input type="checkbox"/>

**CAR SHARING:**

Ha mai sentito parlare di un servizio chiamato Car Sharing?  Si  No

Se sì, è a conoscenza che anche a Brescia presto sarà disponibile un servizio di Car Sharing?  Si  No

*In caso di risposta negativa al primo quesito sul CS:*

Il Car Sharing è un servizio innovativo che, nelle nostre città, può validamente rappresentare un'alternativa efficace e utile all'idea corrente di mobilità. Se già conosce il servizio BiciMia, le modalità di accesso al servizio sono simili e molto semplici: ci si associa ad un circuito che eroga il servizio gestendo una flotta di veicoli di diversa tipologia. L'utente può prenotare e prelevare in qualsiasi momento del giorno e della notte il veicolo richiesto dall'area di parcheggio più vicina. E' una soluzione ideale per spostamenti brevi e frequenti. Un'alternativa per chi percorre pochi chilometri o per chi non intende rinunciare all'auto di proprietà, ma deve fare i conti con esigenze di mobilità che oggi sono risolte con l'acquisto di una seconda o terza macchina.

Alla luce delle sue attuali esigenze di mobilità, ritiene questo servizio interessante?  Si  No

**CAR POOLING:**

Una modalità per ridurre il traffico è quella di condividere il percorso casa-lavoro con altre persone (principio del Car pooling). Lei sarebbe disposto a farlo sapendo che c'è da una parte la possibilità di dividere esattamente i costi del viaggio tra gli occupanti il veicolo e dall'altra di usufruire di privilegi una volta sul posto di lavoro/studio (parcheggi riservati, ecc...)? (Solo una risposta ammessa)

Si	
Si se ho un posto riservato	
Si se conosco prima le persone	
Si se le persone fanno parte di un "club" (quindi esiste un controllo dell'identità)	
Si se il mio tempo di percorrenza non aumenta più di....	
No	


- **Indicator 15 (NUMBER OF TAGGED BICYCLES PER YEAR DURING CIVITAS)** – Using data coming from the Easy Tag national bike register, it's possible to extract the number of registered bike per year. It's also possible to extract some useful information from the same questionnaire administered for the calculation of indicators n 13 and 14, elaborating the answers given to the specific question about the possibility to tag bikes. In particular, the administered question was: "Do you know that it's possible to tag your bike with a specific univocal code that would increase the possibility to retrieve it in case of theft?".

**EX ANTE SITUATION:**

The Municipality of Brescia purchased 2000 kit in 2007 and 2500 in 2010. As the indicator aims at monitoring the variation of the number of tagged bikes during the Civitas project, the ex ante situation is up to June 2010, when a massive distribution of the kit has been organized during specific initiatives.

Year	2007	2008	2009
Number of registerd bikes in Brescia	1026	1577	2341

**AFTER AND EX POST SITUATION**

Year	2010	2011	2012 (partial data until the end of May 2012)
Number of registerd bikes in Brescia	2854	3156	3168

## Annex 3: Cost Benefit Analysis

### Evaluation period for CBA

- *Defining reference case for CBA*  
CBA has been carried out comparing the hypothetical situation without the car-pooling service (reference case or Business-as-Usual scenario) with the Civitas scenario, characterized by the Car-pooling experimentation, which lasted from November 2010 to June 2011.
- *Defining lifetime of the measure*  
The reference year is 2010, when the Municipality of Brescia charged a private local Company to manage the car-pooling service experimentation. At the end of the experimental phase data were collected to monitor the experience. The whole period, taken into consideration by CBA to have a financing return, is 15 years (final CBA year: 2025).
- *Discount rate*  
The average yearly interest rate estimated in the 15 years period of CBA (2010-2025) is 3,5%.

### Method and values for modification

This CBA analysis was made referring to the car-pooling service experimentation.

This CBA considered as “capital costs” the contribution the Municipality of Brescia gave to the Private Company for the management of the experimentation.

As regard the benefits, from a theoretical point of view the introduction of a car-pooling service allows to reduce the car trips at city level and the mileage. As main consequence of that, the fuel consumption and polluting emissions are reduced: this CBA included these positive effects in the economic benefits in terms of operating cost saving at collective level (because they contribute towards the “expenses reduction” of imported goods from foreign countries).

Another benefit related to car-pooling initiative is the reduction of traffic congestion and road accident, but taking into consideration the exiguous number of car-pooling users during the experimentation, this benefit (conservative approach) was considered negligible and not evaluated in this CBA.

From the monitoring carried out in 2011, the total kms run during the car-pooling experimentation were 1.647, which corresponded to a mileage reduction of 3.569 kms at city level. The “kms saved / kms run” ratio is 2,17 and it was assumed constant in the following years of the CBA.

This CBA provides the yearly increasing rate of the kms to be covered by car-pooling users in order to re-pay the investment costs in 15 years (NPV at 2025>0)

- *Description of how the impacts were monetised:*

Fuel saving revenues: the average fuel consumption, referred to a car with medium cubic capacity that runs in urban network, was estimated 11 km/l; the fuel cost adopted by CBA is 0,6 € (economic cost excluding taxes and referred to year 2010).

Emissions costs:

The emission quantities of the main environmental polluting agents are shown in Table 1 for the different car types with medium cubic capacity (running in urban network): grams/km of

carbon monoxide (CO), nitrogen oxides (NO<sub>x</sub>), particulate matter (PM) and carbon dioxide (CO<sub>2</sub>).

TABLE 1 – Polluting emission factors of the different car types (source: Euro normative)

EMISSION FACTOR	GASOLINE CAR				GASOIL CAR			
	EURO1	EURO2	EURO3	EURO4	EURO1	EURO2	EURO3	EURO4
CO emission factor (g/km)	10,52	8,52	8,96	3,90	1,00	0,37	0,26	0,19
NO <sub>x</sub> emission factor (g/km)	0,59	0,31	0,21	0,11	1,21	0,87	0,76	0,44
PM emission factor (g/km)	-	-	-	-	0,13	0,09	0,05	0,03
CO <sub>2</sub> emission factor (g/km)	385,90	385,90	385,90	347,30	276,50	276,50	276,50	248,90

The percentage composition of the different car types running in Brescia town in 2010 is shown in the following Table 2:

TABLE 2 – Car distribution in Brescia province at 2010 (source: ACI)

GASOLINE CAR				GASOIL CAR			
EURO1	EURO2	EURO3	EURO4	EURO1	EURO2	EURO3	EURO4
4%	17%	12%	21%	1%	6%	16%	23%

The money return of the environmental benefits was carried out basing on EU data; in particular the figures (total external costs in urban zone) referred to the main polluting agents (CO, NO<sub>x</sub>, PM and CO<sub>2</sub>) taken into consideration in the CBA, are shown in Table 3 and referred to Euro 2010.

TABLE 3 – Money return of the main polluting agents (€2010/Kg)

EMISSION TYPE	ESTERNAL COST (€2010/kg)
CO emission (*)	0,004
NO <sub>x</sub> emission (**)	3,755
PM emission (**)	434,164
CO <sub>2</sub> emission (**)	0,110

Source: (\*) Astra – Scenario Low External Cost - 2005

(\*\*) HEATCO, D5 Proposal for harmonised Guidelines – Brussels, 2006

- *References of values used*

- ACI statistics (2010)
- Astra – Scenario Low External Cost - 2005
- HEATCO, D5 Proposal for harmonised Guidelines – Brussels, 2006

### Life time cost and benefit

TABLE 4 - Capital cost in the evaluation period (not discounted)

	Cases for comparison	Cost (e.g. €200,000)
Year 0	CIVITAS measure	€ 19,950
(2010)	Reference case (or BAU)	-

TABLE 5 - Operation cost/savings from fuel reductions in the evaluation period (not discounted)

	Cases for comparison	Values (e.g. €200,000)
Year 1	CIVITAS measure	€ 90
	Reference case (or BAU)	€ 285
Year 2	CIVITAS measure	€ 110
	Reference case (or BAU)	€ 347
Year 3	CIVITAS measure	€ 133
	Reference case (or BAU)	€ 421
Year 4	CIVITAS measure	€ 162
	Reference case (or BAU)	€ 512
Year 5	CIVITAS measure	€ 196
	Reference case (or BAU)	€ 622
Year 6	CIVITAS measure	€ 239
	Reference case (or BAU)	€ 756
Year 7	CIVITAS measure	€ 290
	Reference case (or BAU)	€ 918
Year 8	CIVITAS measure	€ 352
	Reference case (or BAU)	€ 1,116
Year 9	CIVITAS measure	€ 428
	Reference case (or BAU)	€ 1,356
Year 10	CIVITAS measure	€ 520
	Reference case (or BAU)	€ 1,647
Year 11	CIVITAS measure	€ 632
	Reference case (or BAU)	€ 2,001
Year 12	CIVITAS measure	€ 768
	Reference case (or BAU)	€ 2,431
Year 13	CIVITAS measure	€ 933
	Reference case (or BAU)	€ 2,954
Year 14	CIVITAS measure	€ 1,134
	Reference case (or BAU)	€ 3,589
Year 15	CIVITAS measure	€ 1,377
	Reference case (or BAU)	€ 4,361

TABLE 6 - Savings from reductions of environmental emissions (not discounted)

	Cases for comparison	Values (e.g. €200,000)
Year 1	CIVITAS measure	€ 64
	Reference case (or BAU)	€ 227
Year 2	CIVITAS measure	€ 78
	Reference case (or BAU)	€ 276
Year 3	CIVITAS measure	€ 94
	Reference case (or BAU)	€ 336
Year 4	CIVITAS measure	€ 115
	Reference case (or BAU)	€ 408
Year 5	CIVITAS measure	€ 139
	Reference case (or BAU)	€ 495
Year 6	CIVITAS measure	€ 169
	Reference case (or BAU)	€ 602
Year 7	CIVITAS measure	€ 206
	Reference case (or BAU)	€ 731
Year 8	CIVITAS measure	€ 250
	Reference case (or BAU)	€ 888

Year 9	CIVITAS measure	€ 303
	Reference case (or BAU)	€ 1,079
Year 10	CIVITAS measure	€ 369
	Reference case (or BAU)	€ 1,311
Year 11	CIVITAS measure	€ 448
	Reference case (or BAU)	€ 1,593
Year 12	CIVITAS measure	€ 544
	Reference case (or BAU)	€ 1,936
Year 13	CIVITAS measure	€ 661
	Reference case (or BAU)	€ 2,352
Year 14	CIVITAS measure	€ 803
	Reference case (or BAU)	€ 2,858
Year 15	CIVITAS measure	€ 976
	Reference case (or BAU)	€ 3,472

Measure title: Mobility Management Actions in Brescia

City: Brescia

Project: Modern

Measure number: 04.06

TABLE 7 - Lifetime cost/benefit of the reference measure/case and CIVITAS measure (discounted)

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>Reference Measure - Business as Usual: traditional transport without car pooling service implementation</b>																
Investment costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel costs	-	285	347	421	512	622	756	918	1.116	1.356	1.647	2.001	2.431	2.954	3.589	4.361
Emissions costs	-	227	276	336	408	495	602	731	888	1.079	1.311	1.593	1.936	2.352	2.858	3.472
<b>Civitas Measure: with implementation of car pooling service</b>																
Investment costs (1)	19.950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel costs	-	90	110	133	162	196	239	290	352	428	520	632	768	933	1.134	1.377
Emissions costs	-	64	78	94	115	139	169	206	250	303	369	448	544	661	803	976
<b>Civitas Measure vs Reference Measure</b>																
Investment costs (1)	- 19.950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel saving revenues (2)	-	195	237	288	350	426	517	628	763	927	1.127	1.369	1.664	2.021	2.456	2.984
Emissions cost saving (3)	-	163	199	241	293	356	433	526	639	776	943	1.145	1.392	1.691	2.055	2.496
TOTAL	- 19.950	359	436	529	643	782	950	1.154	1.402	1.703	2.070	2.515	3.055	3.712	4.510	5.480
OVERALL TOTAL	- 19.950	- 19.591	- 19.156	- 18.626	- 17.983	- 17.201	- 16.251	- 15.097	- 13.695	- 11.992	- 9.922	- 7.408	- 4.353	- 640	3.870	9.350
TOTAL BENEFIT	-	359	436	529	643	782	950	1.154	1.402	1.703	2.070	2.515	3.055	3.712	4.510	5.480
TOTAL COST	19.950	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>INTEREST RATE</b>																
INTEREST RATE	3,5%															
NET PRESENT VALUE	- 19.275	- 18.941	- 18.547	- 18.086	- 17.544	- 16.908	- 16.162	- 15.286	- 14.257	- 13.049	- 11.632	- 9.968	- 8.014	- 5.721	- 3.029	132
BENEFITS/COSTS RATIO	0,00	0,02	0,04	0,07	0,10	0,14	0,19	0,24	0,31	0,40	0,50	0,63	0,78	0,97	1,19	1,47
I.R.R.								-23,8%	-17,8%	-13,0%	-9,0%	-5,6%	-2,8%	-0,3%	1,7%	3,6%

NOTES:

- (1) Contract cost for car pooling implementation
- (2) Fuel saving due to the decreasing of km running
- (3) Emissions saving due to the decreasing of km running

### Summary of CBA results

Table 8 shows the main results of CBA (net present value, benefits/costs ratio, investment rate return), referred to year 2025 (CBA period: 15 years).

TABLE 8 – CBA results between Civitas Measure and Reference Measure/BaU (year 2025)

<b>COST/BENEFIT ANALYSIS</b>	<b>2025</b>
TOTAL KM RUNNING (km)	134.572
TOTAL KM SAVING (km)	291.502
INTEREST RATE	3,5%
NET PRESENT VALUE (€ 2010)	132
BENEFITS/COSTS RATIO	1,47
I.R.R.	3,6%

The car-pooling investment cost of the Civitas measure (19,950 €) is re-paid in 15 years, thanks to the emission and fuel saving, only if the total mileage covered by the car-pooling service is 134'572 km.

This means that, the car-pooling experience in Brescia, which was characterized by an exiguous number of kms covered in 2011 during the experimentation (1.647 km), should increase the mileage covered by the CAR-POOLING service yearly in the next 15 years by 21,5%, in order to register 25'169 kms in 2025 and to reach the cumulative value of 134'572 km (15 years).

As a matter of fact, only with this increasing rate, the Net Present Value and the Benefit/Costs Ratio become respectively higher than zero and higher than one in 15 years.

The Investment Return Rate in 2025 results 3,6%, practically equal to the estimated Interest Rate (3,5%).

## M05.02 – Executive summary

The road accident trend in Brescia has always been monitored thanks to the availability of data coming from ISTAT (National institute of statistics) yearly updated. Information contained in the ISTAT database are considerable: for every single road accident occurred in Brescia it's possible to know, for example, the venue, the involved vehicles, the circumstances, etc. the storage of data is carried out inserting manually data into the computer.

The construction of a GIS platform has been made in years thanks to the close collaboration between the Mobility and Traffic Department of the Municipality of Brescia and the University of Brescia.

The University of Brescia from 1991 to 2002 realized at the beginning the GIS platform, then it kept data updated, integrating ISTAT data with the information coming from the Municipal Police, in order to geo-reference them. Such actions allowed the administration to have a considerable historical data series on which basing the road safety policies.

Since 2003 the contract with the University hasn't been renewed, therefore the activities done by the Municipality were reduced only to the ISTAT data collection (restricted to punctual situations and aiming at funding) and the integration of the information with Municipal Police data was no more implemented.

In this context, the measure developed the following two main aspects:

- A Road Safety Monitoring Centre;
- A Road Safety Urban Plan (PSSU) to be developed in the city of Brescia.

Concerning the Road Safety Monitoring Centre, a new web platform has been realised at the Local Police Station for the road accident relief enhancement. The main activities consisted in developing the software, purchasing palm devices and training the local municipal police on the use of the palm devices during the relief operations.

On the other hand, the PSSU – designed according to the National law requirements – identified black-spots, priority areas of intervention, and road maintenance needs. It can be considered a technical instrument that helps administration political choices regarding road safety.

The activities implemented by the measure allowed the city to manage the road safety problems using a new systemic approach, namely through planning and programming the activities related to road safety. This innovative methodological approach allowed integrated planning actions among different Municipal Departments (mainly Road Department, Public Works Department and Police Department).

It's important to bear in mind that the measure is characterized by activities not having visible impacts on road safety statistics in the short period. In Brescia the number of road accidents increased from 2009 to 2010, while at national level the opposite trend is observed (-1,8%). At the same time in Brescia the crash severity decreased (the number of deaths goes from 14 in 2009 to 6 in 2010), which means that more accidents occurred but they were less serious.

Another important consideration regards data availability. The more complete and official road accidents data came from the Italian National Institute of Statistics (ISTAT), but their late delivery made the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police were considered. Observing both the partial data coming from the Municipal Police and the ISTAT ones, road accidents increased at the intersections and at the same time

decreased along the roads, which means that interventions made on a site likely produced a local accident reduction, but an increase elsewhere, in this case at intersections.

Even if the scarce availability of data (2-3 years) didn't allow to make significant statistical considerations, in general the number of pedestrians and cyclists dead or injured on roads slightly decreased or registered a stable trend.

Finally, in general terms, there is a lack of awareness about the importance of the dissemination of the Urban Road Safety Plan, which is seen by the Local Administration as an internal act, not made to be spread among citizens. This consideration is confirmed by the data collected for indicator n. 8 "Awareness level" about the PSSU, which decreases from 24% (2010) to 8% (2012).

## A. Introduction

### A1 Objectives

The measure objectives are:

(Y) High level / longer term:

- To develop safe and secure roads and infrastructures and means of travels.

(Z) Strategic level:

- To reduce the number of victims in road accidents according to Road Safety urban plan (PSSU);
- To share the information on Road safety (i.e. GIS) among the different Municipality offices.

(AA) Measure level:

- (1) To improve the existing road accident database in order to have the localization of road accidents in a GIS;
- (2) To elaborate the Road Safety urban plan (PSSU) in order to give administrators a local tool to face road safety and in order to reduce road accident by about 13% during the validity period of the plan (2 years);
- (3) To improve road accident reporting through GPS technology;
- (4) To develop the monitoring centre: it allows to have an automatic system for accident database updating/reporting/analysis based on GPS technology and on GIS software.

### A2 Description

The measure consisted mainly in implementing two different topics:

- A Road Safety Monitoring Center; the Road Safety Monitoring Center consisted in realizing a new web platform at the Local Police Station for the road accident relief enhancement: the main activities consisted in realizing the SW, in purchasing palm devices and in training the local municipal police for the use of the palm devices during the relief operations.

- A Road Safety Urban Plan (PSSU) to be developed in the city of Brescia; the PSSU - designed according to the National law requirements - identified black spots, priority areas of intervention, and road maintenance needs. It is a technical instrument that helps political choices of the administration about road safety.

The activities implemented by the measure allowed the city to manage the road safety problems using a new systemic approach, namely through planning and programming the activities related to road safety. This innovative methodological approach allowed integrated planning actions among different Municipal Departments (mainly Road Department, Public Works Department and Police Department) that in time could lead to a significant road safety improvement in the city of Brescia.

## B. Measure implementation

### B1 Innovative aspects

- New organisational arrangements or relationships
- New policy instrument
- New conceptual approach
- Use of new technology/ITS

The innovative aspects of the measure are:

- **Innovative aspect 1 (New organisational arrangements or relationships)** – The Monitoring center aimed at creating an information system which could be easily shared by all the involved sectors of the administration, in order to make more exhaustive analysis using a transversal approach.
- **Innovative aspect 2 (New policy instrument)** – The road safety issues have been faced in the past but not through the use of a tool such as the Urban Road Safety Plan (PSSU).
- **Innovative aspect 3 (New conceptual approach in PSSU development)** – The Road Safety Plan (PSSU) provides technical and objective criteria in order to help the public administration in choosing the most suitable solutions in relation to road safety problems (blackspots). This PSSU is the first plan (developed in Brescia) strictly dedicated to road safety and it is based on the new conceptual approach foresaw in the National Road Safety Plan introduced in Italy in 2002.
- **Innovative aspect 4 (Use of new technology/ITS)** –The road accident database has been managed by the University of Brescia from 1991 to 2003. It's update after 2003 was carried out autonomously by CBS and thanks to the new Monitoring Center it was possible to implement an automatic system for the road accident database updating/reporting/analysis based on GPS technology and on GIS software.  
The main target of the Monitoring Centre was a web platform for the Local Police road accident database management. The new system, based on the purchase of palm devices, was implemented to help the Local Police officers during their road accident reliefs making operations more fast, accurate and complete. The new system easily allowed to include non common information on road accidents, such as the accident localization by absolute GPS coordinates.

### B2 Research and Technology Development

The RTD activities related to the measure implementation consisted in developing the Monitoring Center and in elaborating the PSSU for Brescia.

The RTD activity related to the design of the Monitoring Center was the creation of a web platform for the Local Police road accident relief management.

The research activities consisted in developing a Software able to manage the following:

- ISTAT (i.e. Istituto Nazionale di Statistica, national Statistical Institute) schedule (that is the standard info to be provided at national level on road accidents);

- photos of the accident (useful to implement road safety scenario);
  - standard minutes to be modified on site (useful to speed up reporting actions)
  - location of accidents using GPS (useful to implement road safety actions, reducing mistakes in road accident localisation activity).
  - real time transferring of infos and database implementation;
  - non refined mapping action;
- The SW needed to be used also on palm devices.

The PSSU is the local planning instrument designed to reduce road accidents and it is was instituted in Italy in 2001.

The RTD activities related to the first PSSU implemetnation in Brescia were:

- analysis of existing national guidelines on road safety and of the national Road safety plan
- deepening of international good practices on road safety transport plan (for example: Local Transport Plan in UK – Gloucester experience; Plan de Seguridad Vial in Spain – madrid experience)
- analysis of already existing national experiences at local level (Ravenna, Roma, Bologna)

From the technological point of view the Municipality already uses a GIS SW.

The GIS was set as following:

- Georeferred data using certified ISTAT schedules (historical data series is avealiable since mid '90, logn term data collected)
- Data related to traffic (magnetic detectors and modelling actions)
- Georeferred data using data collected by police a local level - now coming from the Monitorig Centre – (data info available up to 3 years)– short term data collected

The database is used in order to reach a clear mapping of blackspots with evidence of critical sites - road sections or crossroads - where priority actions are needed.

Short term data are particularly useful to calcule road accident rate for road sections.

### **B3 Situation before CIVITAS**

The road accident trend in Brescia has always been monitored thanks to the availability of data coming from ISTAT (National institute of statistics) yearly updated. Information contained in the ISTAT database are considerable: for every single road accident ocured in Brescia it's possible to know, for example, the venue, the involved vehicles, the circumstances, etc. the storage of data is carried out inserting manually data into the computer.

The construction of a GIS platform has been made in years thanks to the close collaboration between the Mobility and Traffic Department of the Municipality of Brescia and the University of Brescia.

The University of Brescia from 1991 to 2002 realized at the beginning the GIS platform, then it kept data updated, integrating ISTAT data with the information coming from the Municipalal Police, in order to georeference them. Such actions allowed the administration to have a considerable historical data series on which basing the road safety policies.

Since 2003 the contract with the University hasn't been renewed, therefore the activities done by the Municipality were reduced only to the ISTAT data collection (restricted to punctual situations and aiming at funding) and the integration of the information with Municipal Police data was no more implemented.

No PSSU was available to manage road safety problems. Decisions were made following political issues based on specific requests coming from the population or according to decision-maker sensitivity.

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Design and implementation of the monitoring center** (from October 2008 to December 2010) – This stage is dedicated to the monitoring center implemented by Telecom.

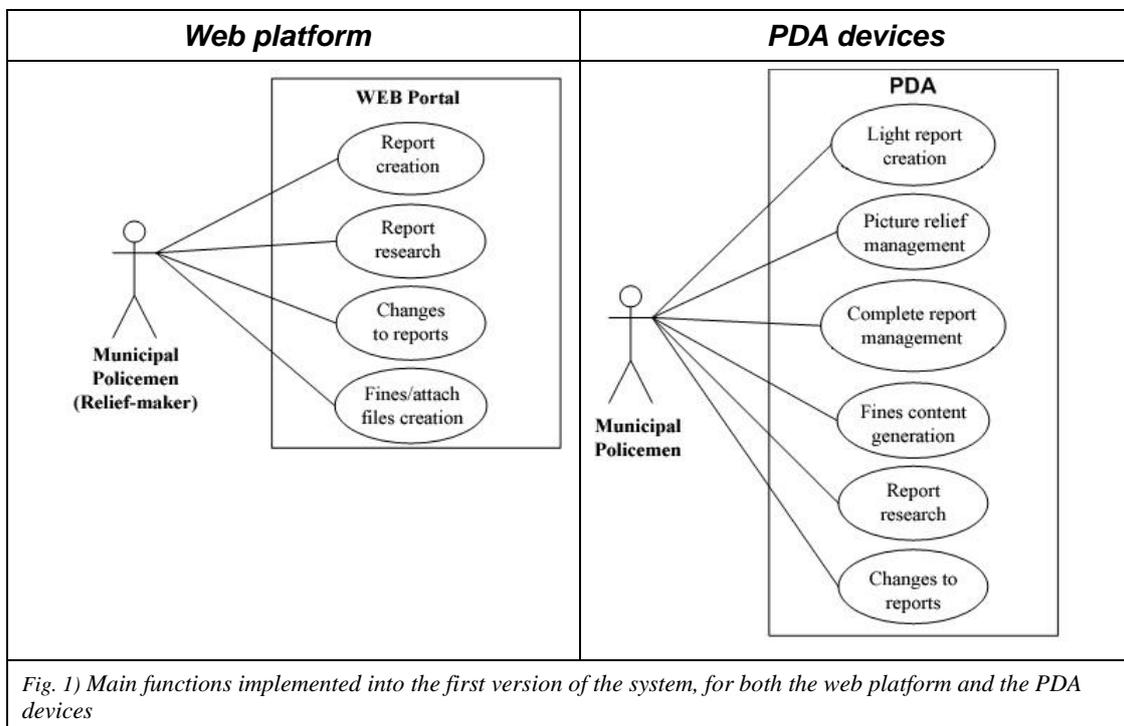
Monitoring center developed by “Telecom” (who won the tender) was composed by:

- a web platform to manage the road accident reporting (Fig. 11 Home page of the WEB platform),
- SW to manage real time data transferring and integrate webplatform with palm devices,
- 4 GPS palm PDA devices,
- 4 printers.

The palm devices were given to the Municipal Police patrols in charge of accidents reliefs. The involved staff was trained for the use of the new system.

The most relevant part of the Telecom project consisted in implementing the information system.

The following scheme (Fig. 10 Main functions implemented into the first version of the system, for both the web platform and the PDA devices) illustrates the main functions implemented into the system, for both the web platform and the PDA devices.



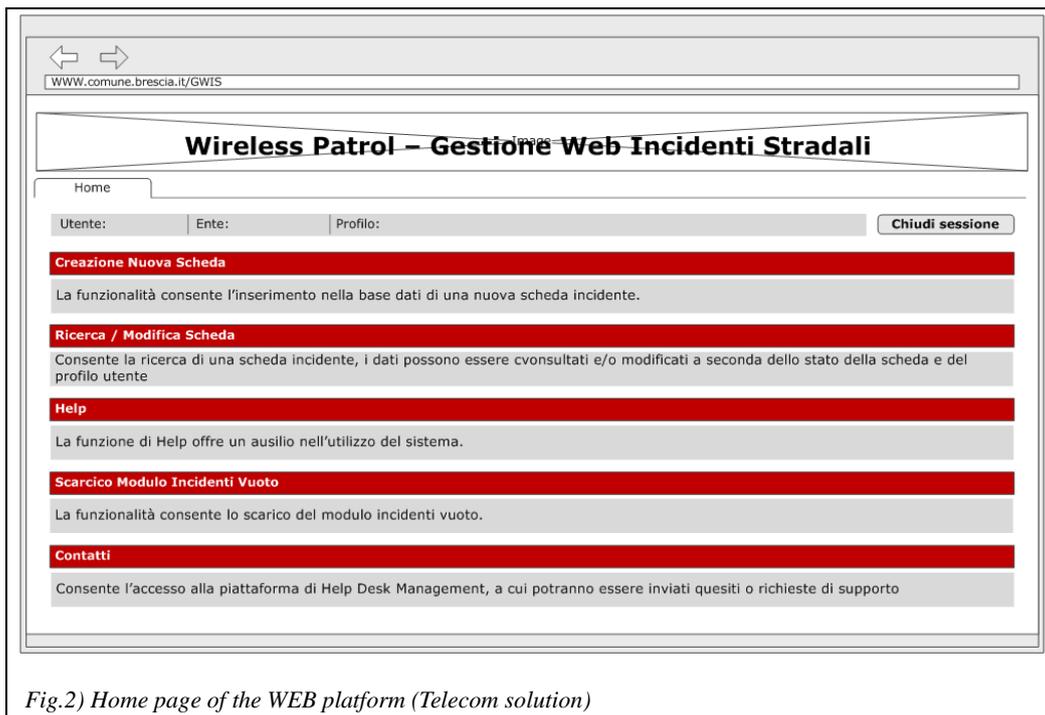


Fig.2) Home page of the WEB platform (Telecom solution)

*Telecom accomplished the most part of the agreed technical solutions.*

*It developed up to 2 versions of the platform,, in order to solve some technical problems emerged during the first operational period (2009).The secon version of the platform was started up at the beginning of 2010. Local Police was trained in order to use the new SW and HW.*

*This platform was operational for about one year. At the end of December 2010 the Local Police Department decided to abandon the Telecom product and to adopt another system better integrated with the other enforcement agencies.*

*This choice was supported by:*

- *several technical problems occurred in managing the SW developed by Telecom (the main provele was related to real time data trasmission and toon site printing – ref. Modulo incidenti Telecom Web Patrol - Test del 30/12/2010)*
- *the growing necessity of the Local Police Department to share information with other enforcement agencies.*

*The new system was developed by “Verbatel – Servizi informatici e telematici” and it is described in the following “Stage 1bis: Design and implementation of the monitoring center – outside the DOW timeplan”.*

**Stage 1bis: Design and implementation of the monitoring center – outside the DOW timeplan** (from December 2010 to October 2012) – *This stage started with the tender for a new system able to manage the same information of the previus platform deveoped by Telecom and to interface with other enforcement agencies. The new tender was won by the company “Verbatel – Servizi informatici e telematici”, - the same who manages the SW/HW system for Carabionieri - which provided a road acc(idents management system based on an integrated platform characterized by other functions (according to the tender requirements). Such new platform allowed the managment of all the activities usually undertaken by the Operative Center of the Municipal Police of Brescia:*

*The SW is organised in the following modules:*

- “Vtrak” module - that subdivided the city in zones of interventions according to competencies of the enforcing agencies;
- “Gestic” module – to manage road accidents (more info are provided below).
- “Integra” module – to support the “Investigative” and “Excise and revenue” managed by Local Municipal Police;
- “Registra” module – to manage activities related to notifications, objects findings, documents inspections and verifications;
- “Rimozioni” module - to manage removed vehicles registering. A specific interface allowed to classify the vehicles basing on vehicle type and model, place of removal, time, date, place of deposit, etc..

In particular, the “Gestic” module dedicated to road accidents management was structured as following:

- data management (uploading and managing of all the data) These kind of data can be uploaded either manually in the Police Department or on the accident site and transmitted to the DB through the use of palms, smartphones and notebooks (Fig. 12). (The SW developed by Telecom allowed data management only trough palms).



Fig. 3) Smartphones and PC tablets used in the new Verbatel system

- graphic function: GPS localization of accidents and CAD mapping.
- standardised accident reporting:. the accident report is automatically edited basing on few and simple information provided by the policeman.
- data transferring to ISTAT: the SW allowed the automatic transmission of collected data to ISTAT DB. The system tracked back the data transfers to avoid duplication.
- first “rough” automatic elaboration: the system provides several automatic elaborations such as graphs, it allow also to integrate info such as accident causes in relation to weather conditions.

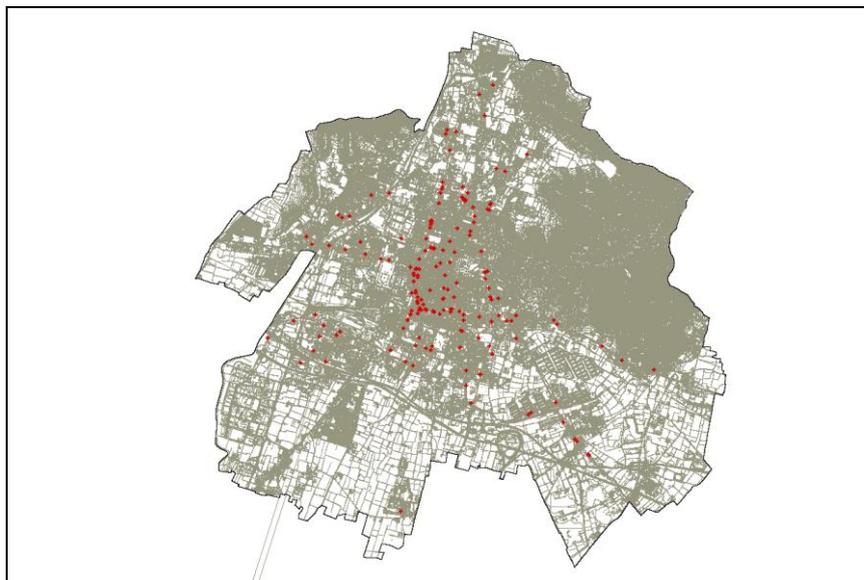
The new system has been in force since January 2012 and the policemen were trained in February 2012.

**Stage 2: Elaboration of the first PSSU, Submission of PSSU to City Council and approval of the scheme** (from October 2008 to January 2010) – The activities consisted in elaborating the methodology to develop the Urban Road Safety Plan (PSSU) in Brescia. The most important purpose of a PSSU is to make lists of critic sites (road segments, intersections or whole roads) in terms of road safety, where interventions are urgent.

*In the case of Brescia, depending on the road safety problems emerged from the aggregate analysis and on the strategies chosen to solve them, different techniques have been used.*

*The road safety data used for the elaborations present in the PSSU of Brescia come from the ISTAT (National Institute of Statistics). Aiming at detecting the black spots, data had been geo-referenced through a GIS software. Besides, the Municipality of Brescia could count also on the availability of traffic data , that allowed the application of a particular procedure for the pinpointing of critic road segments.*

*In order to face particular road accident causes, such as for example the red light infractions or the pedestrian knocking down, the methodology used in the PSSU of Brescia consisted in isolating from the road accidents database the only events concerning that particular cause and the respective list of critic sites where to intervene with priority were obtained counting the number of road accidents occurred for each site in the last three years and listing them in descending order.*



*Fig. 4 Map of the city of Brescia that shows the only accidents due to the red light infractions.*

*To fight against the road safety problems extensively on the municipal territory through punctual engineering actions (which can include infrastructural interventions or more general mobility management measures), two different methodologies were used for the detection of the critic intersections or road segments.*

*As regard the critic intersections, the selected criterion were to count the number of road accidents that in the last three years occurred in each crossroad. The priority list that was elaborated was therefore based on the high frequency of road accidents in terms of absolute value, reporting as dangerous the road junctions where more than two road accidents per year occurred on the average in the time period taken as reference.*

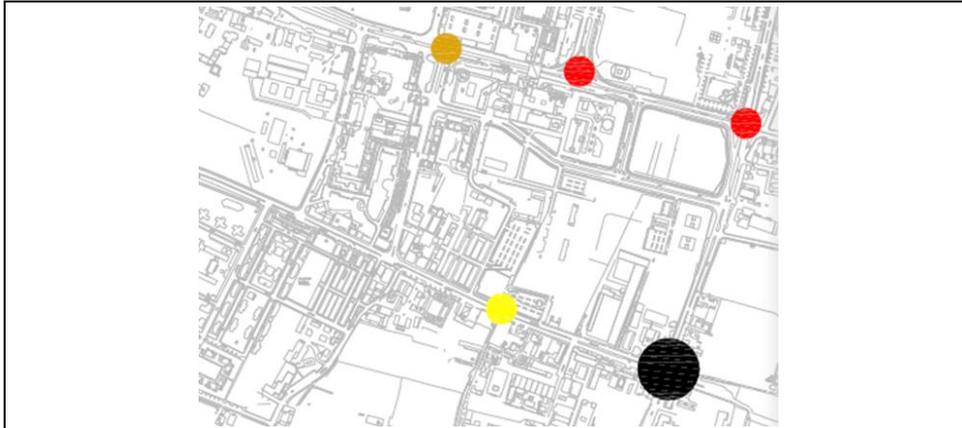


Fig. 5 Extract of the map showing the dangerousness of the road intersection based on the count of the number of accidents occurred in the reference period. The more the colors are dark and the more the intersections are dangerous.

The method adopted for the PSSU of Brescia foresaw the comparison between the road accident rate calculated (that is considered an indicator able to express the dangerousness of a site, because it puts into relation the number of accidents, the road segment length and the amount of traffic) for each homogeneous road segment and the average rate calculated for the road functional class to which the road segment belongs (Maternini, 2000). The most dangerous road segments, placed at the top of the priority lists, are characterized by high road accident rates.

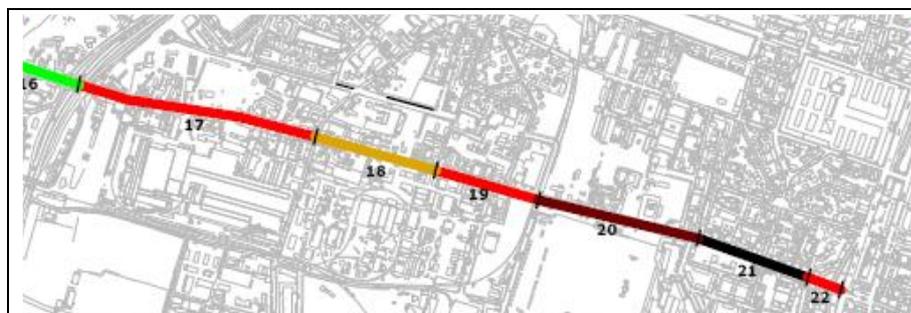


Fig.6 Extract of the map showing the dangerousness of the district road segments basing on the road accident rate value. The more the colors are dark and the more the segments are dangerous.

Lists of priorities and thematic maps where critical trunks or crossroads are displayed were produced (The methodology was applied to the “district roads”, to “inter-district roads” and “inter-zonal roads”).

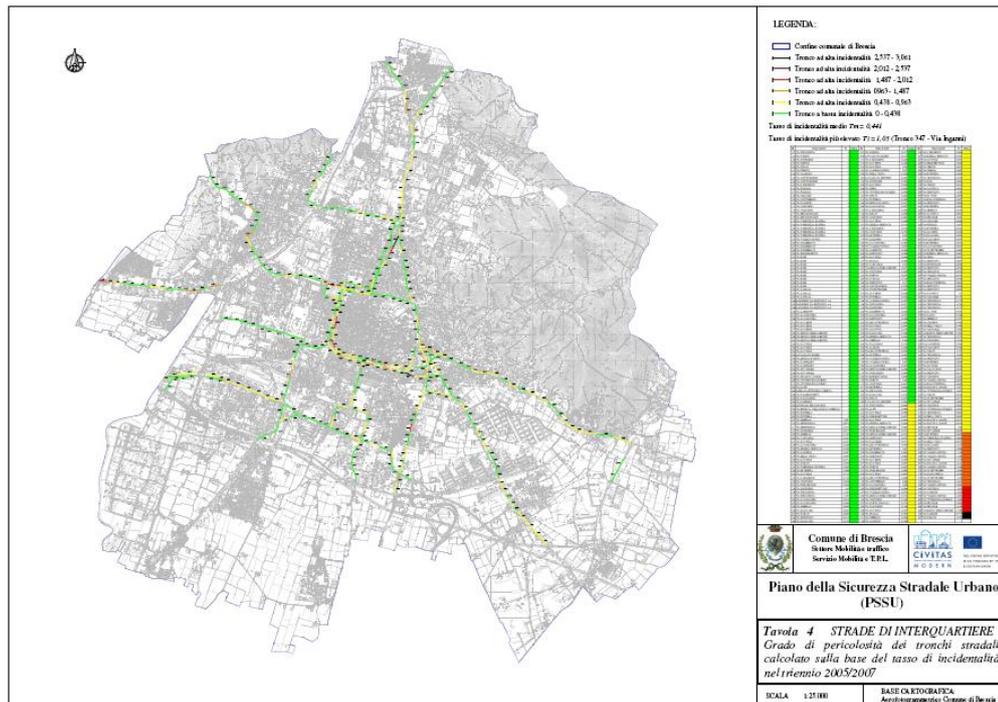


Fig. 7) Mapping of the critical road trunks for the inter-district roads based on the calculation of the road accident rate

For each area of intervention the PSSU foresaw in the “lists of priorities” a detailed analysis is required (disaggregate and / or safety reviews analysis ) in order to identify the main causal factors that provoke the high levels of dangerousness of a site.

The completion of the Plan was accomplished at the end of January 2010 (project-month 15 as scheduled in the timetable).

It's important to say that the formal approval of the plan and its operative launch required more time than the scheduled, because more than one Department of the Public Administration was involved in the formal approval procedure.

**Stage 3: Operational launch of the measure + System running (from February 2010 to October 2012)**

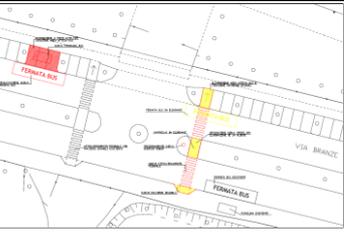
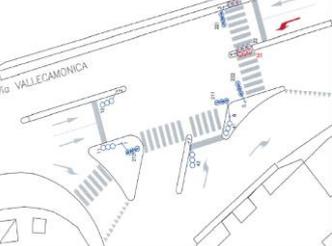
The OP of the measure coincided with the approval of the first PSSU and in its implementation. This stage included also the updating of the road accident mapping (yearly) and of the PSSU itself (every two years).

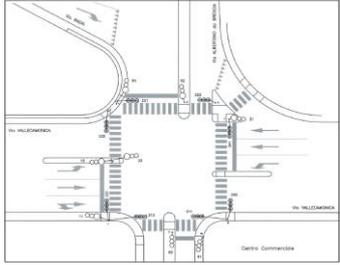
The PSSU of Brescia foresaw the main following activities:

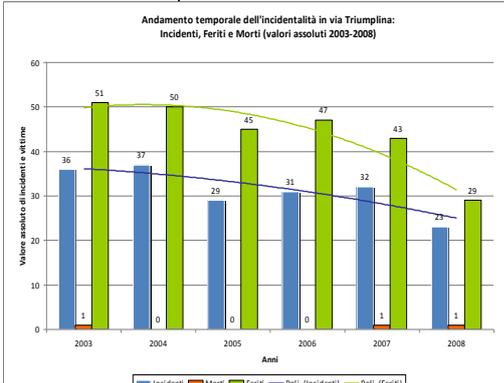
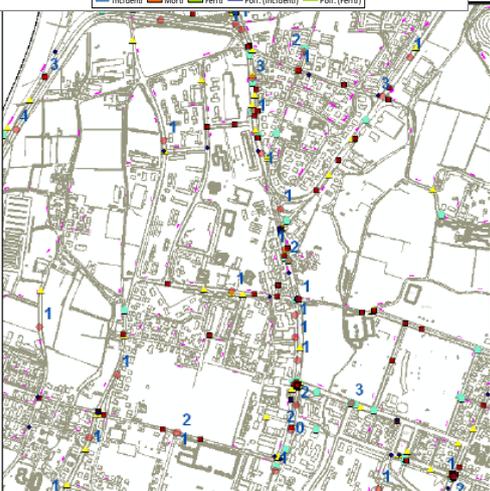
- intervention on infrastructures, such as intersections, crossings, junctions, new technical solutions on traffic lights, speed checks, etc. ;
- road safety campaigns
- enforcement activities.

During Civitas the following interventions on infrastructures were carried out among the most dangerous black spots pointed out in PSSU.

Street	Problem description	Solution / Type of intervention	Photo
<b>New technical solution and enforcement activities</b>			

Street	Problem description	Solution / Type of intervention	Photo
Via Volturno	High speed	Speed Checks	
<b><i>New technical solution and intervention at pedestrian crossing</i></b>			
Via Manara – Via Volturno	Accidents involving pedestrians crossing the road	Traffic light timing, pedestrian island	 
<b><i>Intervention at pedestrian crossing</i></b>			
Via Branze (Faculty of Engineering of the University of Brescia)	Accidents involving pedestrians crossing the road, as the zebra crossings were not placed in relation to pedestrian crossing needs. Extremely dangerous situation due to the high pedestrian traffic flow.	Pedestrian crossings were placed where they were really needed.	 
<b><i>Intervention at junction</i></b>			
Via Vallecamonica – Via Violino	Dangerous junction with Via Violino. The hazard stemmed from vehicles making left turns since the traffic light phases did not provide for this manoeuvre.	In particular, at the junction with via Violino, a new traffic light was installed with a “left turn arrow”, reserving a lane especially for this type of manoeuvre.	

Street	Problem description	Solution / Type of intervention	Photo
<b>New technical solution on traffic lights</b>			
Via Vallecamonica – Via Albertano da Brescia	Dangerous junction with Via Albertano da Brescia: conflicts between vehicles coming from Via Albertano da Brescia and vehicles coming out of the shopping centre car park (simultaneously green of traffic light).	Intervention was carried out adjusting the traffic lights so that is now possible for vehicles to “request” green traffic light for exiting the shopping centre. An exclusive time interval within the cycle of the traffic lights is given to carry out the manoeuvre.	

<b>Road renewal</b>																																													
Street	Problem description	Solution / Type of intervention	Photo																																										
Via Triumplina	Road with a high flow of traffic with many crossroads	Renewal of the road to improve safety, upgrade road junctions - new roundabouts - pedestrian paths - cycle lanes - pedestrian crossings	   																																										
<p>Andamento temporale dell'incidentalità in via Triumplina: Incidenti, Feriti e Morti (valori assoluti 2003-2008)</p>  <table border="1"> <caption>Data from the bar chart: Andamento temporale dell'incidentalità in via Triumplina</caption> <thead> <tr> <th>Anni</th> <th>Incidenti</th> <th>Morti</th> <th>Feriti</th> <th>Poli. (Incidenti)</th> <th>Poli. (Feriti)</th> </tr> </thead> <tbody> <tr> <td>2003</td> <td>36</td> <td>1</td> <td>51</td> <td>36</td> <td>51</td> </tr> <tr> <td>2004</td> <td>37</td> <td>0</td> <td>50</td> <td>37</td> <td>50</td> </tr> <tr> <td>2005</td> <td>29</td> <td>0</td> <td>45</td> <td>29</td> <td>45</td> </tr> <tr> <td>2006</td> <td>31</td> <td>0</td> <td>47</td> <td>31</td> <td>47</td> </tr> <tr> <td>2007</td> <td>32</td> <td>1</td> <td>43</td> <td>32</td> <td>43</td> </tr> <tr> <td>2008</td> <td>23</td> <td>1</td> <td>29</td> <td>23</td> <td>29</td> </tr> </tbody> </table>		Anni	Incidenti	Morti	Feriti	Poli. (Incidenti)	Poli. (Feriti)	2003	36	1	51	36	51	2004	37	0	50	37	50	2005	29	0	45	29	45	2006	31	0	47	31	47	2007	32	1	43	32	43	2008	23	1	29	23	29		
Anni	Incidenti	Morti	Feriti	Poli. (Incidenti)	Poli. (Feriti)																																								
2003	36	1	51	36	51																																								
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2005	29	0	45	29	45																																								
2006	31	0	47	31	47																																								
2007	32	1	43	32	43																																								
2008	23	1	29	23	29																																								

## **B5 Inter-relationships with other measures**

The measure is related to measure M05.03 “Development of bicycle safety”, as it is focused on a particular road users category (cyclists). The indicator used by the latter are collected in PSSU database.

## C. Evaluation – methodology and results

From the evaluation point of view the main objective of the measure consisted on the one hand in the Road Safety Monitoring Center and on the other in elaborating the Road Safety Urban Plan (PSSU) to offer a local planning tool to face road safety.

### C1 Measurement methodology

The indicators were divided into two macro categories: main indicators and complementary indicators.

Main indicators were able to evaluate measure efficiency in terms of objectives achievement.

“Awareness level” was foreseen as complementary indicator.

It’s important to remark that the indicators were set in order to monitor the impact of the PSSU, as for the monitoring centre no tangible output was foreseen except the realization itself<sup>18</sup>.

Regarding the indicator on “Transport safety” foresaw to monitor the PSSU it must be underlined that they were calculated using data coming from ISTAT integrated up to 2011 using data provided by the monitoring centre.

The after data collection (in order to monitor the indicators in itinere and ex post) were foreseen once a year for those indicators that were calculated using data coming from ISTAT, according to the annual delivery of the data.

The administration of the questionnaires (in order to measure the awareness level) was scheduled three times during the whole Civitas project.

All the indicators (except ind. 8 – “Awareness level”) were used to make interesting considerations in relation to the BaU and the up scaling construction.

### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Transport safety	% of accidents on crossroads/ total number of accidents	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
2	Transport safety	% of accidents on roads/on total number of accidents	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
3	Transport safety	Death index	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010

<sup>18</sup> Before December 2010 several data on “Telecom platform” were collected by the Local Policy Department.

4	Transport safety	Pedestrian death/total Vulnerable road Users (VRUs) involved in road accidents	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
5	Transport safety	Pedestrian injured/total Vulnerable road Users (VRUs) involved in road accidents	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
6	Transport safety	Cyclist death/total Vulnerable road Users (VRUs) involved in road accidents	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
7	Transport safety	Cyclist injured/total Vulnerable road Users (VRUs) involved in road accident	ISTAT road accident data; Local Police and a Regional database	Main Indicator First data collection after the OP: year 2010
8	Awareness	Awareness level	Data collected by questionnaires	Complementary indicator First data collection after the OP: April 2011

Detailed description of the indicator methodologies:

- Indicator 1** (*PERCENTAGE OF ACCIDENTS ON CROSSROADS OVER TOTAL NUMBER OF ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents occurred on crossroads. For the ex ante calculation we used ISTAT data referred to years 2005 – 2009. This indicator can be calculated for every year, when the new road accidents data arrive. It's important to notice that the operative phase has been set at the beginning of 2010. Therefore, the ex post data situation will be monitored using Istat data referred to 2010 or data coming from Local Police and a Regional database that collect data that are transferred to ISTAT for validation. This solution can solve the problem of the late arrival of 2010/2011 data from Istat (available in December 2012, after the end of the Civitas project). The timings described above are valid for all the indicator built using data coming from Istat, namely indicators from 1 to 7). More details are reported in Annex 2.
- Indicator 2** (*PERCENTAGE OF ACCIDENTS ON ROADS OVER TOTAL NUMBER OF ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents occurred on roads. With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.
- Indicator 3** (*DEATH INDEX*) - Using data coming from ISTAT, this indicator is calculated with the following formula:  $(M/I)*100$  where M = total death I = total road accidents occurred in the period under consideration. With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.
- Indicator 4** (*RATIO BETWEEN THE NUMBER OF PEDESTRIAN DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving dead pedestrians and total involved VRUs. It's necessary to make the point that VRUs (Vulnerable road Users)= sum of Cyclists and

Pedestrians. With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.

- **Indicator 5** (*RATIO BETWEEN THE NUMBER OF PEDESTRIAN INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving injured pedestrians and total involved VRUs (Vulnerable road Users). With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.
- **Indicator 6** (*RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS (Vulnerable road Users) INVOLVED IN ROAD ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving dead cyclists and total involved VRUs (Vulnerable road Users). This indicator was also scheduled for the measure 05.03 ("Development of bicycle safety in Brescia"). With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.
- **Indicator 7** (*RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS*) - Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving injured cyclists and total involved VRUs (Vulnerable road Users). This indicator was also scheduled for the measure 05.03 ("Development of bicycle safety in Brescia"). With regard to the methodology adopted, the calculation frequency and the data reliability, see the specifications reported above for the indicator n.1.
- **Indicator 8** (*AWARENESS LEVEL*) – This indicator was collected through the administration of questionnaire about road safety perception in Brescia. The target area is extended to the whole urban area of Brescia. The representative sample was chosen among the resident population and the sample size, of 600 filled in questionnaires, was selected among the personal data of the Municipality (this allows a statistical significancy of more than the 90%). The key questions were the following:
  - Do you consider road accidents a priority problem? (Yes/No); What is the priority level that you would give to road accident problem? (High, Medium, Low);*
  - Do you know any initiatives, informative campaigns or measures recently undertaken by the municipality of Brescia that deal with safety on roads? (Yes/No) If yes, which ones and where?;*The specific questions that was used to express the awareness level are the following:
  - The Municipality of Brescia is involved in an European project called "Civitas Plus Modern". Have you ever heard about this project? (Yes/No);*
  - Do you know that, within that project, the Municipality of Brescia is realizing projects dealing with the road safety (For example a Urban Road Safety Plan)? (Yes /No);*

## C1.2 Establishing a Baseline

The Baseline was formulated, on the one hand, considering the kind of available database and its management; on the other, bearing in mind the decisional approach followed for the realization of intervention addressed to the road safety improvement.

Before Civitas the road accident database was regularly georeferenced until 2002, seldom since 2003; any road safety planning tool was elaborated and interventions were based on discretionary criteria.

The Urban Road Safety Plan (PSSU) was elaborated in 2009 and can be considered operative since 2010. Therefore, the year which was taken as reference for the baseline was 2009, except for indicator n. 8 (Awareness level), which was collected for the first time in March 2010.

Indicators	BASELINE (2009)
1) % of accidents on crossroads/ total number of accidents	42,2 %
2) % of accidents on roads/on total number of accidents	57,8%
3) “Death index”	1,44
4) Pedestrian death/total VRUs involved in road accidents	0,0186
5) Pedestrian injured/total VRUs involved in road accidents	0,51
6) Cyclist death/total VRUs involved in road accidents	0,004
7) Cyclist injured/total VRUs involved in road accidents	0,47
8) Awareness level (questionnaire March 2010)	About CIVITAS: 16% About PSSU:24%
Table 1) Baseline values	

### C1.3 Building the Business-as-Usual scenario

Considering the Baseline situation illustrated above, without the Civitas contribution, probably the localization/mapping of the road accidents would have been done occasionally or would even have been stopped, as the collaboration with the University of Brescia wasn't renewed through specific agreements. Choices at the base of the road safety interventions would have been made following subjective criteria, without the help of an organic planning tool.

Thanks to the historical data series available about the road accidents, the BaU scenario was calculated projecting the historical data trend curve for almost all the indicators, except the n. 8 (awareness level about the Civitas project and the elaboration of the PSSU in Brescia) which has no BaU.

BaU calculation projecting the historical data series for ind. 1 “% of accidents on crossroads/ total number of accidents”

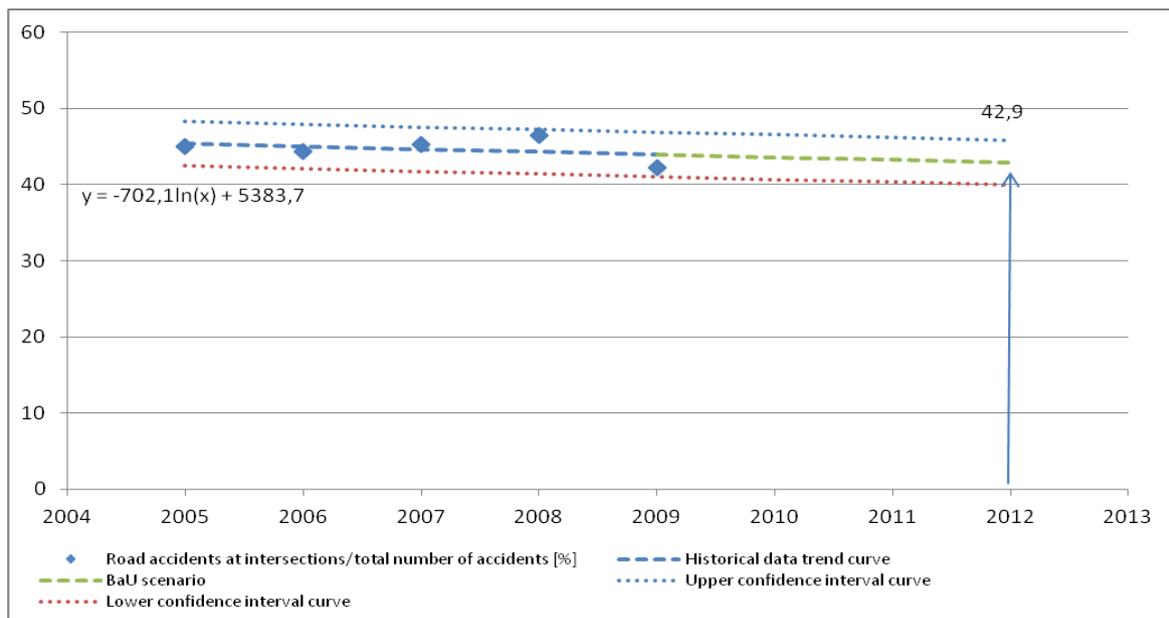


Fig. 9) BaU calculation projecting the historical data series for ind. 1 “% of accidents on crossroads/ total number of

accidents”

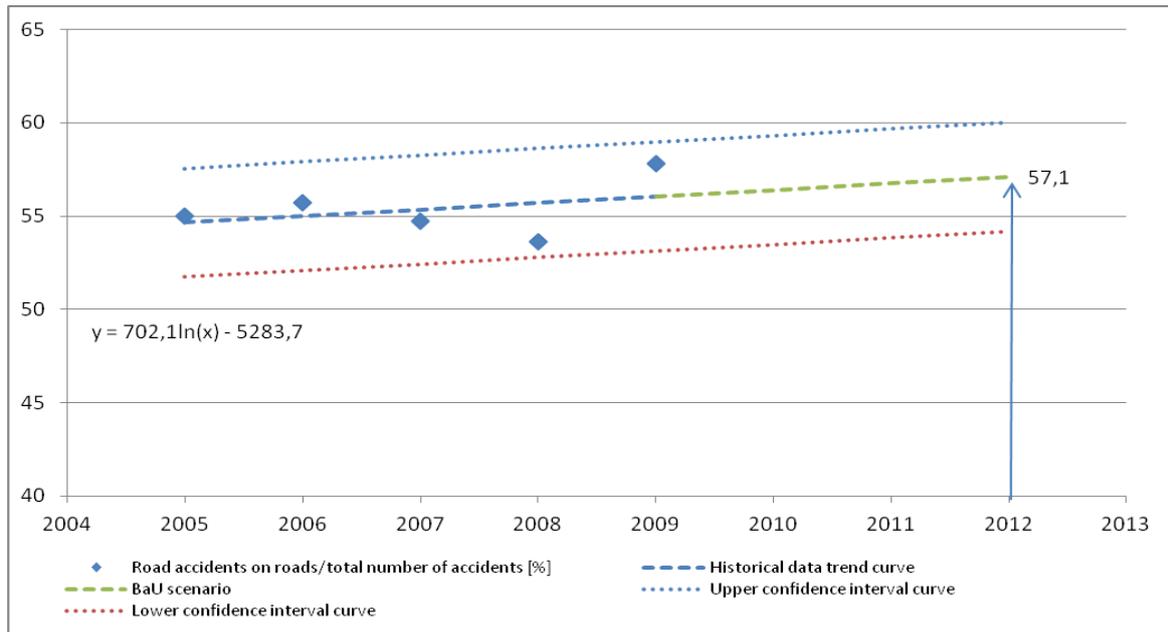


Fig. 10) BaU calculation projecting the historical data series for ind. 2 “% of accidents on roads/on total number of accidents”.

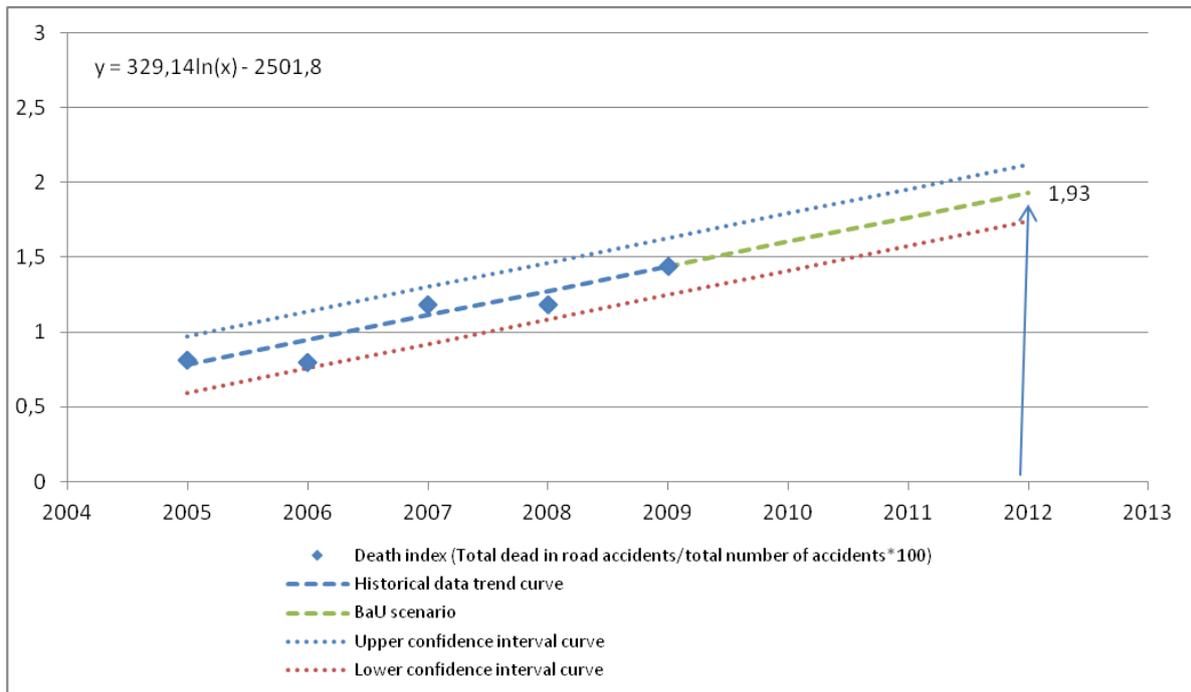


Fig. 11) BaU calculation projecting the historical data series for ind. 3 “Death index” = (Total death/total road accidents)\*100”

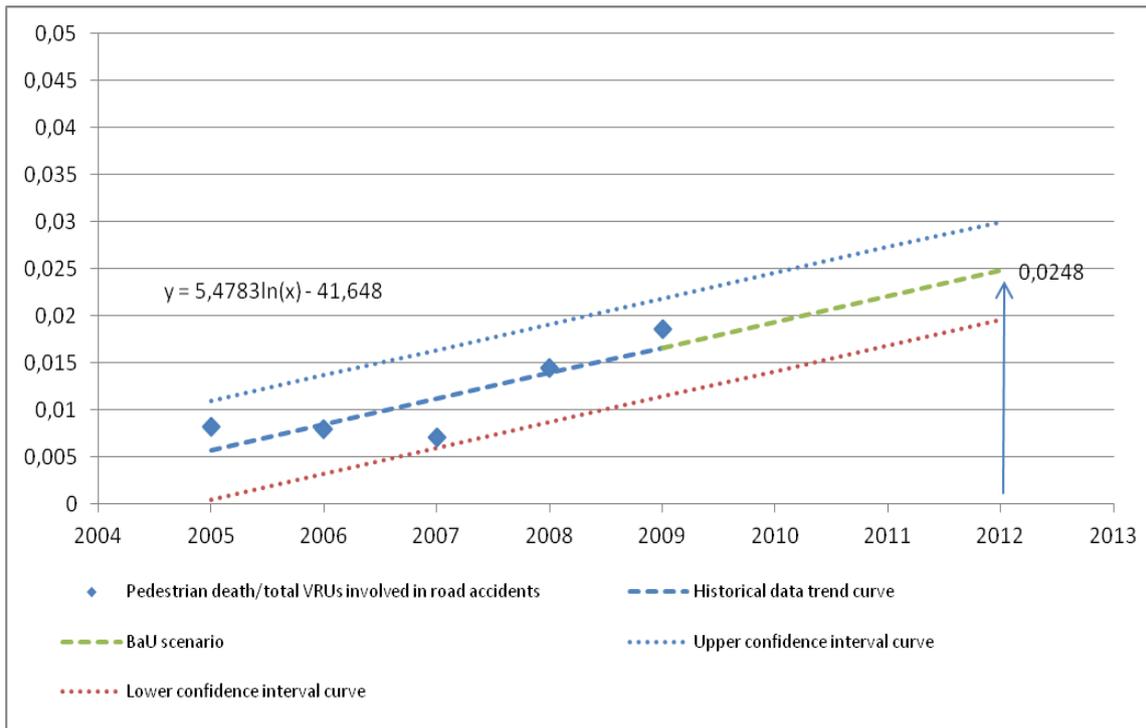


Fig. 12) BaU calculation projecting the historical data series for ind. 4 "Pedestrian death/total VRUs involved in road accidents"

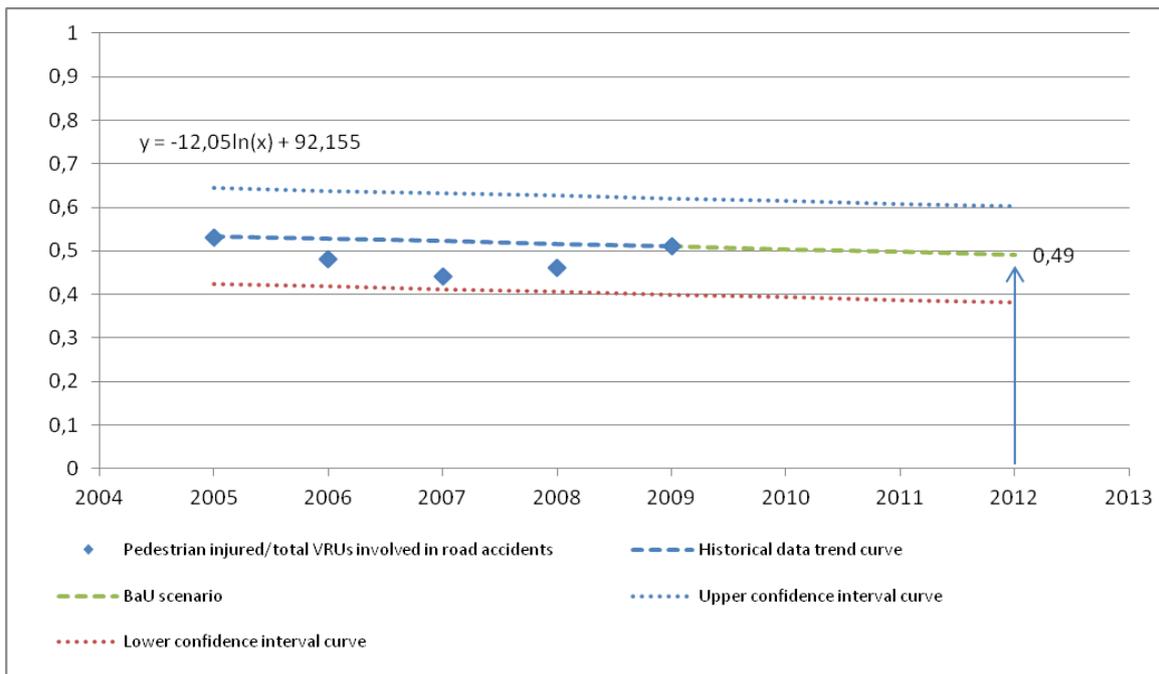


Fig. 13) BaU calculation projecting the historical data series for ind. 5 "Pedestrian injured/total VRUs involved in road accidents"

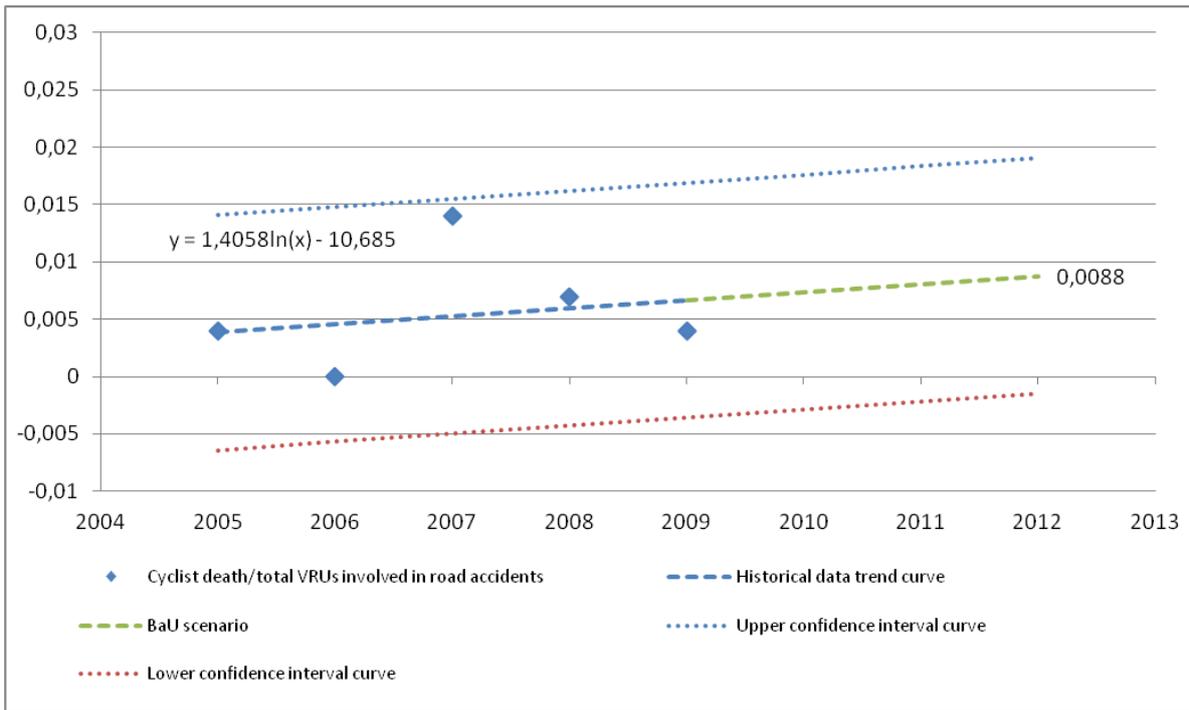


Fig. 14) BaU calculation projecting the historical data series for ind. 6 "Cyclist death/total VRUs involved in road accidents"

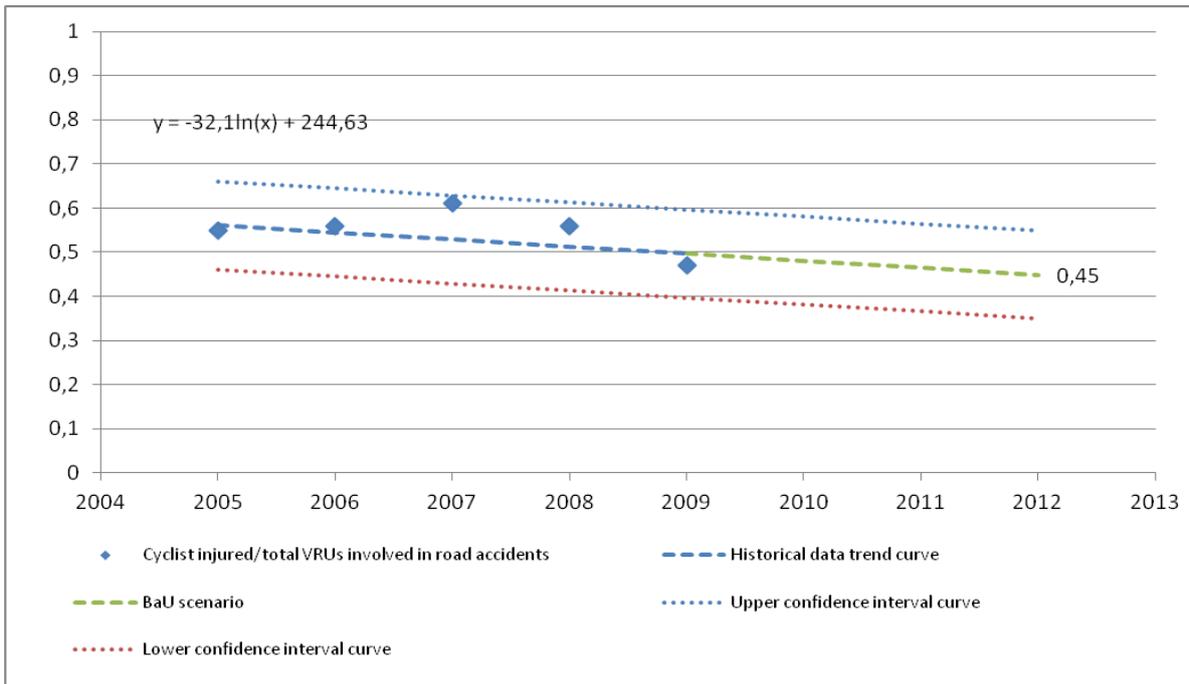


Fig. 15) BaU calculation projecting the historical data series for ind. 7 "Cyclist injured/total VRUs involved in road accidents"

<b>Indicators</b>	<b>BaU (2012)</b>
1) % of accidents on crossroads/ total number of accidents	42,9 %
2) % of accidents on roads/on total number of accidents	57,1%
3) "Death index" = (Total death/total road accidents)*100	1,93
4) Pedestrian death/total VRUs involved in road accidents	0,0248
5) Pedestrian injured/total VRUs involved in road accidents	0,49
6) Cyclist death/total VRUs involved in road accidents	0,0088
7) Cyclist injured/total VRUs involved in road accidents	0,45
8) Awareness level	-
Table 2) BaU values	

## C2 Measure results

The results are presented under sub headings corresponding to the areas used for indicators – Society and Transport.

### C2.1 Transport

**Table C2.1.1: Measure results for the indicators of the category “Transport”**

Indicator	Before (2009)	After	B-a-U	Difference: After –Before	Difference: After – B-a-U	
1) % of accidents on crossroads/ total number of accidents  <b>Proportion=I/LP= 0,87</b>	42,20 % (From ISTAT)	Year 2010: 56,50 %	Year 2010: 43,60%	14,30 %	12,90%	
		Year 2011: (not available)	Year 2011: 43,30%	Not Assessable	Not Assessable	
	48,25 % (Local Police)	Year 2010: 55,68%	Year 2010: 50,11%	7,43 %	5,57%	
		Year 2011: (not available)	Year 2011: 49,77%	Not Assessable	Not Assessable	
	2) % of accidents on roads/on total number of accidents  <b>Proportion=I/LP= 1,12</b>	57,80 % (From ISTAT)	Year 2010: 43,50 %	Year 2010: 56,4%	-14,3 %	-12,9%
			Year 2011: (not available)	Year 2011: 56,7%	Not Assessable	Not Assessable
51,75 % (Local Police)		Year 2010: 44,32 %	Year 2010: 50,36%	-7,43 %	-6,04%	
		Year 2011: (not available)	Year 2011: 50,62%	Not Assessable	Not Assessable	
3) “Death index”  <b>Proportion=I/LP = 0,94</b>		1,44 %	Year 2010: 0,60 %	Year 2010: 1,6 %	-0,84 %	-1,00%
			Year 2011: (not available)	Year 2011: 1,77%	Not Assessable	Not Assessable
	1,53 (Local Police)	Year 2010: 0,67	Year 2010: 1,7	-0,86	-1,03	
		Year 2011: 0,52	Year 2011: 1,88	-1,01	-1,36	

Indicator	Before (2009)	After	B-a-U	Difference: After – Before	Difference: After – B-a-U
4) Pedestrian death/total VRUs involved in road accidents <b>Proportion=I/LP = 1,11</b>	0,0186 (From ISTAT)	Year 2010: 0,00	Year 2010: 0,0193	-0,0186	-0,0193
		Year 2011: (not available)	Year 2011: 0,0221	Not Assessable	Not Assessable
	0,0167 (Local Police)	Year 2010: 0,00	Year 2010: 0,0173	-0,0167	-0,0173
		Year 2011: 0,008	Year 2011: 0,0199	-0,0087	-0,0119
5) Pedestrian injured/total VRUs involved in road accidents <b>Proportion=I/LP = 0,93</b>	0,51 (From ISTAT)	Year 2010: 0,53	Year 2010: 0,50	0,02	0,03
		Year 2011: (not available)	Year 2011: 0,50	Not Assessable	Not Assessable
	0,55 (Local Police)	Year 2010: 0,51	Year 2010: 0,54	-0,04	-0,03
		Year 2011: (not available)	Year 2011: 0,54	Not Assessable	Not Assessable
6) Cyclist death/total VRUs involved in road accidents	0,004 (From ISTAT)	Year 2010: 0,00	Year 2010: 0,0074	-0,004	-0,0074
		Year 2011: (not available)	Year 2011: 0,0081	Not Assessable	Not Assessable
	0,00 (Local Police)	Year 2010: 0,00	Year 2010: 0,00	0,00	0,00
		Year 2011: 0,008	Year 2011: 0,00	0,008	0,008
7) Cyclist injured/total VRUs involved in road accidents <b>Proportion=I/LP = 0,94</b>	0,47 (From ISTAT)	Year 2010: 0,47	Year 2010: 0,48	0,00	-0,01
		Year 2011: (not available)	Year 2011: 0,46	Not Assessable	Not Assessable
	0,50 (Local Police)	Year 2010: 0,50	Year 2010: 0,45	0,00	0,05

Indicator	Before (2009)	After	B-a-U	Difference: After –Before	Difference: After – B-a-U
		Year 2011: (not available)	Year 2011: 0,43	Not Assessable	Not Assessable

## C2.5 Society

**Table C2.2.1: Measure results for the indicators of the category “Society”**

Indicator	Before (March 2010, before formal approval of PSSU)	After	B-a-U	Difference: After –Before	Difference: After – B-a- U
8) Awareness level	About CIVITAS: 16%  About PSSU:24%	(April 2011)	(April 2011)		
		About CIVITAS: 6%	About CIVITAS: 0%	- 10%	+ 6%
		About PSSU: 8%	About PSSU: 0%	- 16%	+8%
		(April 2012)	(April 2012)		
		About CIVITAS: 9,7%	About CIVITAS: 0%	- 6,3%	+9,7%
		About PSSU: 8%	About PSSU: 0%	- 16%	+8%

It's important to bear in mind that this Measure is characterized by activities, which haven't a visible impacts on road safety statistics in the short period. Alongside this, the following considerations can be made, according to the results observed during the Civitas measure implementation.

In Brescia the number of road accidents increased from 2009 to 2010, while at national level the opposite trend is observed (-1,8%). At the same time in Brescia the crash severity decreased (the number of deaths goes from 14 in 2009 to 6 in 2010), which means that more accidents occurred but they were less serious (it's possible to see this phenomenon through indicator 3 “death index”).

Another important consideration regards data availability. The more complete and official road accidents data came from the Italian National Institute of Statistics (ISTAT), but their late delivery made the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which was one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) were considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are usually most involved.

Observing both the partial data coming from the Municipal Police and the ISTAT ones, road accidents increased at the intersections and at the same time decreased along the roads (indicators n.1 and 2), which means that interventions made on a site likely produced a local accident reduction, but an increase elsewhere, in this case at intersections.

Even if the scarce availability of data (2-3 years) didn't allow to make significant statistical considerations, in general the number of pedestrians and cyclists dead or injured on roads slightly decreased or registered a stable trend, as it's possible to see for indicators n. 4, 5, 6 and 7.

Even if the impacts of planning actions on road safety are tangible in the medium/long period, the effectiveness of the PSSU, from a quantitative point of view, can be highlighted in these terms:

- thanks to the implementation of the plan, a reduction of the road accidents severity was registered, in spite of the road accidents general trend;
- as regards the general trend of road accidents, both at national level and at city level, the number of accidents in which VRUs were involved decreased in terms of percentage.

A further consideration should be made: a recent survey, carried out by the University of Brescia within the Project SOL (Save Our Life) about the road accidents, showed some interesting results. In particular, 459 inhabitants of the East Lombardy took part to a Public Opinion Survey by means of an on-line questionnaire. The respondents answered the following question according to a 7-point scale "To what extent do you agree with the following statements". The following table includes the main results of that survey (higher score means bigger acceptance of the statement):

<i>Statement</i>	<i>M</i>
Dangerous situations on the road happen to us because of a bad luck	3.11
I often feel that I do not have influence on things that happen to me on the road	5.12
I am responsible myself for things that happen to me on the road	2.09
Some people are just born unlucky and they are also unlucky on the road	5.17

Table 3) Source: ALOT (2011), Italy - Brescia: SOL Community Situational Assessment Baseline Report (contributors: Maurizio Tira, Angela Ortogni, Silvia Rossetti and Michela Tiboni)

The collected information highlighted that road accidents were actually considered as a fatality. The survey made evidence of the users psychological passive resistance in understanding that road safety is strictly linked to road design and road interventions, rather than to fortune.

In the end, in general terms, there is a lack of awareness about the importance of the dissemination of the Urban Road Safety Plan, which is seen by the Local Administration as an internal act, not made to be spread among citizens. This consideration is confirmed by the data collected for indicator n. 8 "Awareness level" about the PSSU, which decreases from 24% (2010) to 8% (2012).

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>Improvement the existing road accident database in order to have the localization of road accidents in a GIS.</p> <p>This objective can be considered achieved in full.</p> <p><i>The indicators able to express this achievement are the following: indicators 1 (% of accidents on crossroads/ total number of accidents) and 2 (% of accidents on roads/on total number of accidents), which are calculated thanks to database queries and which are useful to find critical points where a riqualfication is needed.</i></p>	**
2	<p>Elaboration of the Road Safety urban plan (PSSU) in order to give administrators a local tool to face road safety and to reduce road accident about 13% during the validity period of the plan (2 years)</p> <p>Therefore, the objectives can be summarized as follows:</p> <ul style="list-style-type: none"> <li>- elaboration of the Plan;</li> <li>- road accident reduction</li> </ul> <p>Elaboration of the Plan</p> <p><i>In the first case, actions are linked with the information contained in PSSU and the administrators understood the importance to have and to consult a plan made "ad hoc" for the road safety improvement; The objective can be considered exceeded because the PSSU has been realized and already updated once during Civitas. The second goal wasn't achieved because the total number of accidents increased</i></p> <p><i>Before (2009):973</i>  <i>After (2010): 1003</i></p> <p><i>On the contrary, the severity of road accidents decreased, as observed for indicator n. 3 "Death index":</i></p> <p><i>Before (2009):1,44</i>  <i>After (2010): 0,60</i></p> <p><i>This means that a reduction of the road accidents severity has been registred, in spite of the road accidents general trend, which slightly increased.</i></p>	***
	<p>Road accident reduction</p> <p><i>On the contrary, the severity of road accidents decreased, as observed for indicator n. 3 "Death index":</i></p> <p><i>Before (2009):1,44</i>  <i>After (2010): 0,60</i></p> <p><i>This means that a reduction of the road accidents severity has been registred, in spite of the road accidents general trend, which slightly increased.</i></p>	O
3	<p>To improve road accident reporting through GPS technology</p> <p><i>This objective can be considered achieved in full because a new system for the road accident relief was introduced. This new platform foresees the use of palmtops and tablets during the road accident reliefs able to recur to the GPS technology for the precise localization of the accident.</i></p>	**
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full            *** = Exceeded</b></p>		

## C4 Up-scaling of results

For this Measure is not possible to predict an upscaling of the results, as it is already dedicated to the whole population and to the whole Municipal urban area.

## C5 Appraisal of evaluation approach

The evaluation approach firstly considered the project objectives as expressed explicitly in the original evaluation plan. The data collection methodology and the data quality were sufficient to evaluate the measure performance.

Indicators were selected at the beginning of Civitas project and the chosen ones belonged to the categories “Transport” and “Society”. In the first part, indicators were able to monitor the road accidents occurred in the urban area, divided by the different mobility components and infrastructure (road or intersection).

One indicator (no. 8 "Awareness") belonged to the category “Society” and provided the population knowledge about CIVITAS project and about the PSSU.

From the evaluation process point of view, it was important to monitor the application of the Plan, in order to evaluate the possible barriers that could lead to its abandon and to avoid its lack of efficiency. On the other hand, it was also interesting to investigate the potential drivers that could, instead, bring to its success.

## C6 Summary of evaluation results

The key results are as follows:

- **Key result 1** – the realization of the Monitoring Center brought to the enhancement of the road accident reporting activity for the Local Police Department. This means that the road accident reliefs were made easier, faster and more accurate.
- **Key result 2** – PSSU can be considered a good result because in Italy the elaboration of this important planning tool is not very spread;
- **Key result 3** – Civitas initiative favoured the constant updating and mapping of the road accident database.
- **Key result 4** – the PSSU is an useful tool and is consulted by the Administration to prioritize road safety actions.

## C7 Future activities relating to the measure

Among the possible activities related to the measure, which can be carried out at the end of Civitas, the most important activity is to keep the plan updated and monitored.

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## D. Process Evaluation Findings

### D0 Focused measure

This measure is not a focused one.

### D1 Deviations from the original plan

The most significant deviation from the original plan was related to the monitoring center implementation. According to the activities scheduled in the DOW, a first system was successfully activated. By the end of 2010 the Local Police Department decided to abandon that system and to implement another one, most suitable to its needs. In particular, instead of a platform dedicated only to the road accident reporting, a platform able to manage all the Local Police services was activated in 2012.

### D2 Barriers and drivers

#### D2.1 Barriers

The most significant barrier was encountered during the operation phase:

- **Barrier 1 Organizational** – During the operation phase of the Monitoring Center, some problems were encountered in the features supported by the first system: The Local Police detected limits in the system implemented by Telecom, therefore the Police decided to abandon it and to implement a new system, able not only to manage the road accident reporting, but also to share infos among enforcement agencies.

#### D2.2 Drivers

The following main drivers were experienced during the measure implementation, namely:

##### During the preparation phase.

- **Driver 1 Positional** – Road safety was considered a priority in Brescia and was an important issue shared by the politicians (in particular by the Mobility and Traffic Committee chairman) in the political agenda. This priority was very helpful in delivering the road safety actions.

##### During the operation phase.

- **Driver 2 Planning** – The PSSU is a useful planning tool for the detection and managing of the most critical points of road safety. In particular, the PSSU allows to give priorities to the road safety actions and where infrastructural interventions are required (road segments or intersections), specific analysis are made in order to understand the road safety problems that characterize the black spots, so that an accurate/targeted design solutions of the road spaces are possible;
- **Driver 3 Organizational** - Constructive involvement of different Municipality Departments for the measure activity (Informatics and Mobility and Traffic Departments) was helpful in succeeding in the road safety actions;

- **Driver 4 Organizational** – A better definition of the Local Police needs in terms of service management allowed to develop a better solution for the monitoring Center.

## D2.2 Activities

During the operation phase of the Monitoring Center, in order to get over the experienced barrier, several meetings were arranged with the software developer, trying to solve the detected problems.

During the operation phase of the PSSU infrastructural interventions were realized aiming at improving road safety in the most dangerous black spots of the city.

The dissemination activities carried out in Brescia during the measure implementation contributed to inform population about the road safety issues concerning Brescia.

## D3 Participation

### D.3.1 Measure partners

The partners involved in this measure were the Brescia Municipality and the Local Police.

The Municipality of Brescia is the promoter of all the planning actions in Brescia. In particular, the Mobility and Traffic Department was in charge of planning and implementing the road safety actions and the Statistics Department of the Municipality of Brescia was in charge of collecting the Istat data concerning the City of Brescia.

The Local Police was in charge of reporting road accidents when they occurred in the urban area of Brescia, together with other enforcement agencies such as Carabinieri, National Police, Province Police, etc. The local policies concerning safety and security are defined by the Municipality of Brescia and are then implemented through the Local Municipal Police.

### D3.2 Participation of stakeholders

In this measure stakeholders were represented by the inhabitants of the city of Brescia. Their direct involvement was possible through administering them a survey; another category of stakeholders was represented by the Local Police, who was involved in the realization of the Monitoring Center and in the training activities.

### D4.1 Recommendations: measure replication

- **Recommendation 1 – customization.** The operative version of the Monitoring Center needs to be developed basing on a technology that doesn't require any particular care to be transferred, even if a customization to the specific organizational requirements is needed. Moreover this software allows the updating of the accident database either through smart-phones or notebooks, without the necessity to acquire any particular devices.
- **Recommendation 2 – transfer operation.** *The system implemented in Brescia has a high level of transferability and its implementation is recommended to improve the accidents relief and management. Of course the used product reflects the organization of the work existing in Brescia and the Italian legislation and rules for detecting and collecting accidents data. These aspects must be taken into account for any transfer operation. Anyway the experience developed in Brescia can be an useful guide.*

## D4.2 Recommendations: process

- **Recommendation 1 – Priority sharing.** It's very important to share the priority toward road safety among the policy makers, the citizens and the Municipalities Departments. Namely, it's helpful to spread the awareness concerning the PSSU utility in order to better coordinate and deliver the road safety actions;
- **Recommendation 2 – To train the personnel.** It's fundamental to train the personnel in charge of fill in the road accident database and to explain the importance of their activities, in order to prevent errors and to improve the road accident database quality.
- **Recommendation 3 – Data availability.** In order to lay out an effective PSSU, it's important to verify the availability of the required data at city level, namely, the geo-referenced road accident data and the traffic data set.
- **Recommendation 4 – Steadily update the database.** The data updating phase is an important process which must be done constantly, in order to have a common framework to be taken as reference;
- **Recommendation 5 – Users need definition.** As regards the Monitoring Centre, a better definition of the Local Police needs in terms of service management allowed to develop a better solution for the monitoring Centre.

## Annex 1: Historical data series for the BaU calculation

### Indicator 1 (PERCENTAGE OF ACCIDENTS ON CROSSROADS OVER TOTAL NUMBER OF ACCIDENTS)

Year	2005	2006	2007	2008	2009
Road accidents on intersections	607	556	575	513	411
Total Road accidents	1350	1254	1270	1106	973
Of which unknown localization	5	7	14	5	0
ratio	0,4496	0,4434	0,4528	0,4638	0,4224
%	45,0	44,3	45,3	46,4	42,2

### Indicator 2 (PERCENTAGE OF ACCIDENTS ON ROADS OVER TOTAL NUMBER OF ACCIDENTS)

Year	2005	2006	2007	2008	2009
Accidents on roads	743	698	695	593	562
Total road accidents	1350	1254	1270	1106	973
Of which unknown localization	5	7	14	5	0
ratio	0,5504	0,5566	0,5472	0,5362	0,5776
%	55,0	55,7	54,7	53,6	57,8

### Indicator 3 (DEATH INDEX)

Year	2005	2006	2007	2008	2009
Morti totali	11	10	15	13	14
Incidenti totali	1350	1254	1270	1106	973
Death index	0,81	0,80	1,18	1,18	1,44

### Indicator 4 (RATIO BETWEEN THE NUMBER OF PEDESTRIAN DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)

Year	2005	2006	2007	2008	2009
pedestrian dead	2	2	2	4	5
total VRUs involved	245	252	283	277	269
ratio	0,0082	0,0079	0,0071	0,0144	0,0186
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	153	127

### Indicator 5 (RATIO BETWEEN THE NUMBER OF PEDESTRIAN INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)

Year	2005	2006	2007	2008	2009
Pedestrian injured	131	122	125	127	137
Total VRUs involved	245	252	283	277	269
ratio	0,53	0,48	0,44	0,46	0,51
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	153	127

**Indicator 6 (RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)**

Year	2005	2006	2007	2008	2009
Cyclist dead	1	0	4	2	1
Total VRUs involved	245	252	283	280	269
ratio	0,004	0,000	0,014	0,007	0,004
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	156	127

**Indicator 7 (RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)**

Year	2005	2006	2007	2008	2009
Cyclist injured	134	140	172	157	126
Total VRUs involved	245	252	283	280	269
ratio	0,55	0,56	0,61	0,56	0,47
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	156	127

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1 (PERCENTAGE OF ACCIDENTS ON CROSSROADS OVER TOTAL NUMBER OF ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents occurred on crossroads.

### EX ANTE:

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Road accidents on intersections	411
Total Road accidents	973
Of which unknown localization	0
ratio	0,4224
%	42,2

### AFTER:

Year	2010
Road accidents on intersections	567
Total Road accidents	1003
Of which unknown localization	0
ratio	0,5653
%	56,5

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 0,87

Year	2010
ratio	0,5568
%	55,68

- **Indicator 2 (PERCENTAGE OF ACCIDENTS ON ROADS OVER TOTAL NUMBER OF ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents occurred on roads.

### EX ANTE:

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Accidents on roads	562
Total road accidents	973
Of which unknown localization	0

ratio	0,5776
%	57,8

**AFTER:**

Year	2010
Accidents on roads	436
Total road accidents	1003
Of which unknown localization	0
ratio	0,4347
%	43,5

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occurs to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 1,12

Year	2010
ratio	0,5062
%	50,62

- **Indicator 3 (DEATH INDEX)** – This indicator follows this formula:  $(M/I)*100$  where M = total death I = total road accidents occurred in the period under consideration (with regard to the calculation frequency and the data reliability, see the specifications reported for the first indicator).

**EX ANTE:**

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Dead total	14
Total accidents	973
Death index	1,44

**AFTER:**

Year	2010
Dead total	6
Total accidents	1003
Death index	0,60

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occurs to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 0,94

Year	2010
Death index	0,67

Year	2011
Death index	0,52

- **Indicator 4 (RATIO BETWEEN THE NUMBER OF PEDESTRIAN DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving dead pedestrians and total involved VRUs (VRUs = sum of Cyclists and Pedestrians).

**EX ANTE:**

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
pedestrian dead	5
total VRUs involved	269
ratio	0,0186
Pedestrian involved	142
Cyclists involved	127

**AFTER:**

Year	2010
pedestrian dead	0
total VRUs involved	271
ratio	0,0
Pedestrian involved	144
Cyclists involved	127

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 1,11

Year	2010
ratio	0,00

Year	2011
ratio	0,008

- **Indicator 5 (RATIO BETWEEN THE NUMBER OF PEDESTRIAN INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving injured pedestrians and total involved VRUs.

**EX ANTE:**

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Pedestrian injured	137
Total VRUs involved	269
ratio	0,51
Pedestrian involved	142
Cyclists involved	127

**AFTER:**

Year	2010
Pedestrian injured	144
Total VRUs involved	271
ratio	0,53
Pedestrian involved	144
Cyclists involved	127

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 0,93

Year	2010
ratio	0,51

- **Indicator 6 (RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving dead cyclists and total involved VRUs. This indicator is also scheduled for the measure M05.03 ("Development of bicycle safety in Brescia").

**EX ANTE:**

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Cyclist dead	1
Total VRUs involved	269
ratio	0,004
Pedestrian involved	142
Cyclists involved	127

**AFTER:**

Year	2010
Cyclist dead	0
Total VRUs involved	271
ratio	0,00
Pedestrian involved	144
Cyclists involved	127

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Year	2010
ratio	0,00

Year	2011
ratio	0,008

- **Indicator 7 (RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)** – Using data coming from ISTAT, it's possible to extract data concerning the only accidents involving injured cyclists and total involved VRUs. This indicator is also scheduled for the measure M05.03 (“Development of bicycle safety in Brescia”).

**EX ANTE:**

The ex ante situation of this indicator considers data referred to the year 2009:

Year	2009
Cyclist injured	126
Total VRUs involved	269
ratio	0,47
Pedestrian involved	142
Cyclists involved	127

**AFTER:**

Year	2010
Cyclist injured	127
Total VRUs involved	271
ratio	0,47
Pedestrian involved	144
Cyclists involved	127

As regards availability of data, the more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data coming from the Municipal Police (which is one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes) have been considered. Municipal Police collects the most part of the road accidents occurring in urban areas, where vulnerable road users are most involved.

Proportion=I/LP= 0,94

Year	2010
ratio	0,50

- **Indicator 8 (AWARENESS LEVEL)** – The initial idea was to charge the statistical unit staff with realizing, distributing, collecting and analyzing specific questionnaires. Furthermore, we thought about the possibility of including in the same questionnaire the survey for the “Awareness level” indicator scheduled for the measure 05.03 (“Development of bicycle safety in Brescia”). The reasons are mainly 2: the first one is that the two measures are similar in the contents; the second one is that we try to optimize the survey costs. As far as this measure is concerned, the questionnaire made by the statistical unit staff will focus on the awareness level about road safety. The target area is extended to the whole urban area of Brescia. The representative sample is to be chosen among the resident population (this choice is based on operative considerations: extending the survey also to the gravitating population would have introduced too many complications and would have increased the costs). The sample size, of 600 filled in questionnaires, can be selected among the personal data of the Municipality (this allows a statistical significance of more than the 90%). Involved families will be visited by a certificated person in charge for the compilation of the questionnaire.

The key questions could be similar to the followings:

*Do you consider road accidents a priority problem? (Yes/No); What is the priority level that you would give to road accident problem? (High, Medium, Low);*

*Do you know any initiatives, informative campaigns or measures recently undertaken by the municipality of Brescia that deal with safety on roads? (Yes/No) If yes, which ones and where?;*

The specific questions that can be used to express the awareness level are the following:

*The Municipality of Brescia is involved in an European project called “Civitas Plus Modern”. Have you ever heard about this project? (Yes/No);*

*Do you know that, within that project, the Municipality of Brescia is realizing projects dealing with the road safety (For example a Urban Road Safety Plan)? (Yes /No);*

Following an “Ex-ante/ex-post” approach, the administration of the questionnaires (in order to measure the awareness level) is scheduled three times during the whole Civitas project. The same questionnaire has been administered the first time in March 2010, the second time in April 2011 and the last one it will be administered in April 2012.

#### **EX ANTE SITUATION (MARCH 2010):**

We experienced some organizational problem with the Statistical Unit staff: they couldn’t guarantee the availability of the certificated detectors in charge of administering the questionnaires, so we had to charge an external company to manage this drawback. As the survey based on face to face interviews required more time than the scheduled, to collect a significant ex-ante before the implementation of the measure, we chose a faster procedure that slightly differs from the initial one scheduled: the questionnaires have been administered by phone. The sample size characteristics are the same described above. The company’s duty is to administer the questionnaires by phone, to collect them, to enter data in a database and to elaborate the results.

#### **Results elaboration:**

To reach the goal of 600 filled in questionnaires, the company contacted 787 families. Only 220 of them answered to the phone calls but thanks to the fact that families are generally composed by more than one members, we collected totally **601 filled in questionnaires**. The questionnaires have been administered **from 5<sup>th</sup> February to 3<sup>rd</sup> March 2010**. This period can be considered as a valid ex ante for this measure even if the milestone (referred to the approval of the PSSU) was scheduled in January (project month 15). The justification to this apparent delay in data collection, comes from the fact that even if the milestone has been formally

respected, the actual approval of the PSSU requires more time (even months) because of bureaucratic procedures involving several departments of the public administration.

The calculated indicator is composed by 2 results: the awareness level of the population respect to the CIVITAS project in general and respect to the PSSU implemented in the ambit of the specific measure 05.02. These 2 results are expressed by percentage of people who has knowledge of a specific aspect respect to the total number of people who answered the questionnaire.

- Awareness level about CIVITAS: **16,00%**
- Awareness level about PSSU: **24,00%**

#### **AFTER DATA COLLECTION (APRIL 2011):**

The beginning of the questionnaire administration (the same distributed during the previous survey) started by the end of April 2011 and ended by the end of May 2011. The results of the survey arrived in June and are reported below:

- Awareness level about CIVITAS: **6,00 %**
- Awareness level about PSSU: **8,00 %**

#### **AFTER DATA COLLECTION (APRIL 2012):**

- Awareness level about CIVITAS: **9,70 %**
- Awareness level about PSSU: **8,00 %**

The used questionnaire is reported below:



**Comune di Brescia**  
*Settore Mobilità e Traffico*  
*Assessorato alla Mobilità e Traffico*



**INDAGINE “CIVITAS PLUS”**  
sul livello di conoscenza dei progetti  
“Centro di Monitoraggio per la sicurezza stradale”, “Miglioramento  
della sicurezza per i ciclisti”, “Car sharing” e “Car pooling”

**Scheda familiare**  
**Anno 2009**

**Informazioni sull'indagine**

Il Comune di Brescia è coinvolto, dall'ottobre 2008, in un programma europeo chiamato Civitas Plus Modern. Tale programma riunisce in un consorzio 4 città europee (Brescia, Vitoria Gasteiz, Craiova e Coimbra) impegnate nell'implementazione di progetti che mirano alla mobilità sostenibile, alla riduzione dell'inquinamento e alla sicurezza. Le misure cofinanziate dalla Comunità Europea e portate avanti dalla città di Brescia sono in totale 14 e conseguono gli obiettivi del programma europeo agendo su fronti diversi: si stanno portando avanti progetti che vanno dalla promozione dell'uso di carburanti alternativi e mezzi ad elevata efficienza energetica allo sviluppo di sistemi integrati di bigliettazione del trasporto pubblico, dall'organizzazione di campagne informative allo studio di soluzioni innovative per gli spostamenti casa/lavoro o per le merci in città, dalla pianificazione della sicurezza stradale allo sviluppo di sistemi innovativi per la gestione della domanda per il trasporto pubblico.

Per i sotto progetti riguardanti il Centro di Monitoraggio per la sicurezza stradale, il miglioramento della sicurezza per i ciclisti, il Car Sharing e il Car pooling, gestiti dal Comune Di Brescia, è prevista, mediante indagini campionarie presso la popolazione residente, un'attività periodica di monitoraggio per valutare il livello di conoscenza dei progetti da parte della cittadinanza.

Il presente questionario raccoglie informazioni anche su aspetti demografici e sociali della famiglia intervistata, ma la scheda è anonima e la sua compilazione è facoltativa e lasciata alla disponibilità e collaborazione delle famiglie.

**Ringraziamo le famiglie rispondenti e tutte le persone coinvolte nella rilevazione per la collaborazione.**

Codice Famiglia	<input type="text"/>
Codice rilevatore	<input type="text"/>
Data di consegna	<input type="text"/>
Numero di componenti	<input type="text"/>
Circoscrizione di residenza	<input type="text"/>
Quartiere di residenza	<input type="text"/>

1

### Componente 1

Relazione di parentela	1 Intestatario scheda anagrafica		
Sesso	F	M	Anno di nascita
Stato civile	1 Nubile/celibe	2 Coniugata/o	3 Separata/o Divorziata/o
			4 Vedova/o
Titolo di studio	1 Nessuno	2 Licenza elementare	3 Diploma media inferiore
	4 Diploma media superiore o professionale	5 Laurea	
Condizione professionale	1 Occupato	2 Disoccupato/in cerca di lavoro	3 Casalinga
	4 Ritirato dal lavoro	5 Studente	6 Altro

Qual'è il principale mezzo di trasporto che utilizza abitualmente per...	Tragitto casa/lavoro o casa/scuola	Spese, commissioni, accesso ai servizi	Tempo libero	Altri spostamenti
Piedi	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1	<input type="checkbox"/> 1
Bicicletta	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2	<input type="checkbox"/> 2
Ciclomotore	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3	<input type="checkbox"/> 3
Automobile	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4	<input type="checkbox"/> 4
Trasporto pubblico	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5	<input type="checkbox"/> 5

Prima di essere contattato per questa indagine, era a conoscenza del Progetto Civitas Plus per la mobilità sostenibile, pulita e sicura?

Sì  No

#### SICUREZZA STRADALE:

Lei è a conoscenza di campagne informative (realizzate nelle scuole, in città, ecc) sul tema degli incidenti stradali?  Sì  No

Se sì, può precisare tramite quali mezzi di comunicazione? (Scelta multipla)

Cartelloni pubblicitari	<input type="checkbox"/>
Volantini o brochures	<input type="checkbox"/>
TV locali	<input type="checkbox"/>
Stampa	<input type="checkbox"/>
Siti web	<input type="checkbox"/>
Radio	<input type="checkbox"/>
Altro	<input type="checkbox"/>

Specificare "altro"

Solo per i maggiori di 14 anni:

Considera prioritario il problema dell'incidentalità?

Sì  No

Quale grado di priorità attribuirebbe ad interventi intrapresi al fine di risolvere tale problema?

Alto  Medio  Basso

Tra le cause di incidente prevalenti riportate qui di seguito, qual è quella che le desta più preoccupazione?

Infrazioni semaforiche	<input type="checkbox"/>
Eccesso di velocità	<input type="checkbox"/>
Mancato rispetto di stop/precedenza	<input type="checkbox"/>
Mancato rispetto della distanza di sicurezza	<input type="checkbox"/>
Manovre/attraversamenti/svolte irregolari	<input type="checkbox"/>
Sosta vietata agli incroci o presso gli attraversamenti pedonali	<input type="checkbox"/>
Stato psico-fisico alterato	<input type="checkbox"/>
Altro	<input type="checkbox"/>

Specificare "altro"

E' a conoscenza del fatto che il Comune, attraverso il progetto Civitas Plus, intende dotarsi di un Piano della Sicurezza Stradale Urbano (PSSU) proprio per cercare di risolvere il problema dell'incidentalità stradale?

Sì  No

Quali sono le categorie di utenti della strada da favorire nell'ambito di una pianificazione della sicurezza stradale? Potrebbe fornire un ordine di priorità?

Automobilisti	<input type="checkbox"/>
Pedoni	<input type="checkbox"/>
Ciclisti	<input type="checkbox"/>
Motociclisti e ciclomotoristi	<input type="checkbox"/>
Autobus	<input type="checkbox"/>

#### BICICLETTA:

Negli ultimi 6 mesi, ha utilizzato la bicicletta?  Sì  No

*Prosegue la compilazione solo chi ha risposto Sì al quesito precedente:*

Negli ultimi 6 mesi, ha utilizzato le piste ciclabili?  Sì  No

Ritiene che i percorsi ciclabili, siano sufficientemente segnalati e riconoscibili?  Sì  No

Conosce e ha utilizzato la mappa dei percorsi ciclabili cittadini?

Non sapevo dell'esistenza della mappa dei percorsi ciclabili	<input type="checkbox"/>
Conosco la mappa, ma non l'ho mai usata	<input type="checkbox"/>
Conosco la mappa e l'ho utilizzata saltuariamente	<input type="checkbox"/>
Conosco la mappa e la utilizzo spesso	<input type="checkbox"/>

Come giudica la dotazione di rastrelliere per biciclette in città nei luoghi da lei frequentati?

Inadeguata	<input type="checkbox"/>
Adeguate	<input type="checkbox"/>
Eccessiva	<input type="checkbox"/>

E' a conoscenza del fatto che il Comune, attraverso il progetto Civitas, intende dotare tutti i percorsi ciclabili cittadini di un'apposita segnaletica di direzione, nonché rinnovare e migliorare la segnaletica orizzontale e verticale esistente ed incrementare il numero delle rastrelliere in città?  Sì  No

Conosce la possibilità di dotare la sua bicicletta di un codice univoco e di un'apposita targhetta adesiva che consenta, in caso di furto, di aumentare la possibilità di ritrovamento?

Sì, ma la mia bicicletta non è ancora dotata di targa	<input type="checkbox"/>
Sì e la mia bicicletta è già dotata di targa	<input type="checkbox"/>
Sì, ma non mi interessa/non credo sia efficace	<input type="checkbox"/>
No, ma mi interessa	<input type="checkbox"/>
No, non mi interessa	<input type="checkbox"/>

#### CAR SHARING:

Ha mai sentito parlare di un servizio chiamato Car Sharing?  Sì  No

Se sì, è a conoscenza che anche a Brescia presto sarà disponibile un servizio di Car Sharing?  Sì  No

*In caso di risposta negativa al primo quesito sul CS:*

Il Car Sharing è un servizio innovativo che, nelle nostre città, può validamente rappresentare un'alternativa efficace e utile all'idea corrente di mobilità. Se già conosce il servizio BiciMia, le modalità di accesso al servizio sono simili e molto semplici: ci si associa ad un circuito che eroga il servizio gestendo una flotta di veicoli di diversa tipologia. L'utente può prenotare e prelevare in qualsiasi momento del giorno e della notte il veicolo richiesto dall'area di parcheggio più vicina. E' una soluzione ideale per spostamenti brevi e frequenti. Un'alternativa per chi percorre pochi chilometri o per chi non intende rinunciare all'auto di proprietà, ma deve fare i conti con esigenze di mobilità che oggi sono risolte con l'acquisto di una seconda o terza macchina.

Alla luce delle sue attuali esigenze di mobilità, ritiene questo servizio interessante?  Sì  No

**CAR POOLING:**

Una modalità per ridurre il traffico è quella di condividere il percorso casa-lavoro con altre persone (principio del Car pooling). Lei sarebbe disposto a farlo sapendo che c'è da una parte la possibilità di dividere esattamente i costi del viaggio tra gli occupanti il veicolo e dall'altra di usufruire di privilegi una volta sul posto di lavoro/studio (parcheggi riservati, ecc...)? (Solo una risposta ammessa)

Si
Si se ho un posto riservato
Si se conosco prima le persone
Si se le persone fanno parte di un "club" (quindi esiste un controllo dell'identità)
Si se il mio tempo di percorrenza non aumenta più di....
No


## **M05.03 – Executive summary**

The Cycle Mobility Plan elaborated in 2000 (within the 1998 Urban Transport Plan) aimed at realizing almost exclusively new cycle lane kilometres in order to favour the implementation of long and safe cycle routes for citizens.

No attention was given to the renewal of the existing cycle routes and to their quality. This has led to a progressive worsening of the infrastructures and to a progressive lack of itineraries integration, with a consequent decreasing of the cyclists' comfort and of the perceived safety. Furthermore no systematic and targeted dissemination activities were carried out by the Municipality, except for publication of info on the Municipality web site.

In this framework the measure aimed at the renewal of existing itineraries to be in line with the administration policy focused on the promotion of cycling through the improvement of comfort, quality and safety.

Three main actions were then carried out: signing (either horizontal and vertical signs); publication and distribution of cycling maps; realization of dedicated bicycle parking equipping them with lockable racks.

About 95km of the existing cycle routes have been renewed during Civitas, with a slight contribution in reducing road accidents (indicators were selected to monitor cyclists safety in the city); moreover, about 1'100 parking slots were introduced. Specific indicators were also implemented to check the awareness levels on cycle routes renewal.

The results showed that 80% of the total bicycle network has been renewed and more than the scheduled 170 signs - both horizontal and vertical – have been installed.

Alongside this, thanks to the publication and distribution of 5'000 cycle maps the information of possible itineraries has been enhanced and, as a consequence, the awareness level about cycle itineraries renewal increased by 4.75% (from 16.25% in the ex-ante situation to 21% after the measure implementation).

Then, the cycle parking area has been enlarged and new cycle racks installed: with respect to the 120 planned racks 1'098 slots have been realized (considering that each rack is composed by a variable number of slots).

Observing both the partial data coming from the Municipal Police and the ISTAT ones the number of cyclists dead or injured on roads slightly decreased or registered a stable trend. It's important to highlight that in general Brescia registered in the period 2009-2010 an increasing number of accidents and injured people, but at the same time a decrease of the number of dead people and of the road accident severity.

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(BB) High level / longer term:

- to promote cycling improving comfort and safety;
- to protect and enhance the “soft” mobility modes such as walking and cycling

(CC) Strategic level:

- to carry out the EU and National road safety policy (reduction of 50% cyclists victims in road accidents within 2020);

(DD) Measure level:

- (1) to improve the quality of cycling itineraries through direction signing (about 100 km of bicycle lanes), i.e. implementation of the new signing system (170 signs) along 13 itineraries;
- (2) to improve information of possible itineraries trough the publication and distribution of 5.000 cycle maps;
- (3) to improve bicycle services and prevent bicycle thefts increasing of bicycle parking areas (up to 35%) equipping them with 120 locking racks;
- (4) to improve cyclists’ safety, reducing accidents (20%) and victims.

### **A2 Description**

The Municipality of Brescia aimed to promote cycling by improving comfort, quality and safety for users. This strategic objective was expressed into 3 main actions during the Civitas initiative improving:

- the quality of cycling itineraries (Fig. 1) through appropriate signing (either horizontal and vertical signs);
- information about possible itineraries trough the publication and distribution of cycling maps;
- bicycle services and preventing bicycle thefts through the realization of dedicated bicycle parking equipping them with racks.

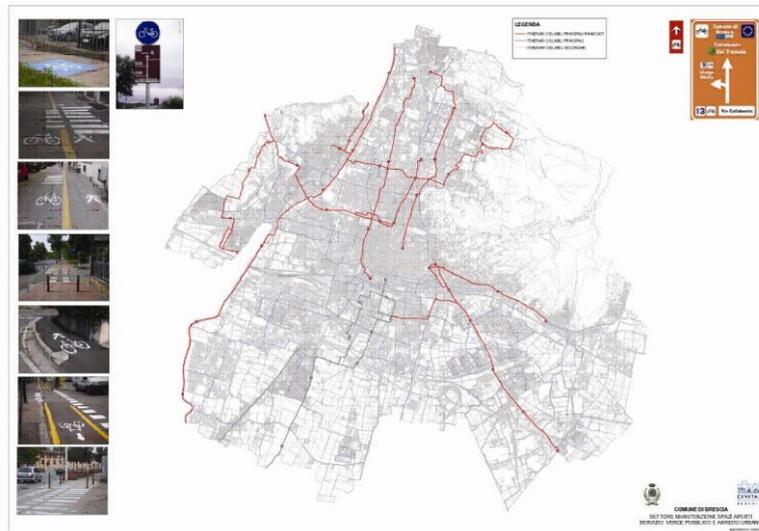


Fig. 1: Cycling itineraries in Brescia

The development of this measure led to a new Cycle Mobility Plan published in 2011.

In fact in November 2009, the Mobility staff of the Municipality deliberated the updating of the Cycle Mobility Plan (approved in 2000).

The contribution of the measure to the Plan (Fig. 2) was related to technical aspects such as the signals and equipment needed in the different itineraries. Civitas contributed to the drafting of the new maps of the cycle itineraries – that were planned scheduling a new classification of the cycle lanes and tracks with some changes in the direction of the same itineraries.



Fig.2 The new Cycle Mobility Plan (April, 2011): it deal with the cycle network extension, the technical characteristics of the cycle paths, the cycle racks implementation and the development of safety for cyclists.

During Civitas the existing cycle tracks and lanes (not only the main itineraries, but also the secondary one) were investigated in order to identify the dangerous points (intersections/interruptions/need of horizontal and vertical signing) that needed to be requalified (Fig. 3).



Fig. 3: One of the investigated itineraries

The measure allowed to handle the existing cycle itineraries and during the measure implementation several segments were requalified, obtaining about 100 kms of requalified cycle network.

Alongside this, the measure aimed at improving the user's safety through the planning of maintenance activities, through preliminary survey, listing of the itineraries, positioning of appropriate signing where missing, equipping parking with racks.

Owing to the implementation of this measure the cycle network was improved and made safer and thanks to the Cycle Mobility Plan the network will allow an integrated mobility with the new metro line (start up foreseen by 2013) which foresees the possibility of loading bicycles in its carriages.

## **B. Measure implementation**

### **B1 Innovative aspects**

- New conceptual approach
- Targeting specific user groups
- New policy instrument
- New physical infrastructure solutions

The innovative aspects of the measure are:

- **New conceptual approach** – It's the first time that in Brescia a dedicated signing for cyclists has been introduced in cycle itineraries. Direction signing for cyclists aim at users orientation, A clear orientation is important also to prevent cycle accidents (bad and poor signing can confuse the cyclists who can take the wrong direction) and to encourage road users to use the bicycle. To favor intermodality and users' comfort safe bicycle racks have been set up along the cycle itineraries,
- **Targeting specific user groups** – The specific target group was, of course, composed by cyclists and in particular, two main targets have been pursued: safety (prevention of road accident) and security (safer parking through the installation of cycle racks).
- **New policy instrument** – The activities developed in the measure itself were used by the Municipality as "demo activities" to find suitable solutions to be standardized and proposed in the Cycle Mobility Plan. The measure to be developed required an active coordination among different public administration departments.
- **New physical infrastructure solutions** – The measure was implemented through the physical installation of the new re-designed signs and of the new bicycle racks. The new cycle racks introduced give the possibility to link the bike chassis and the wheel with a padlock.

### **B2 Research and Technology Development**

The Italian Highway Code doesn't give specific indications for cycle itineraries signing and, at present, there often is little signing in cycling routes.

The RTD activities consisted of an accurate investigation and urban analysis of the existing cycle routes to define location, size and function of the new signals, as well as to define the demand for cycle parking. Cycle paths and lanes were assessed by technicians and the cyclists' association, in order to identify dangerous points such as intersections, interruptions, need of horizontal and vertical signing. Not only the main routes, but also secondary paths were taken into account. The contributions of the local Bike Friends Association affiliated with FIAB (known as Associazione Amici della Bici "Corrado Ponzanelli") was useful and valuable. The association was directly involved in the existing cycle route inspections. After a first analysis of the general situation, some routes were more deeply

investigated and used as references.. The format used in these inspections (Fig. 4, Fig. 5) was focused on the following elements:

- location;
- photos;
- type of cycle route (cycle lane, cycle track, mixed cycle/bus, greenway etc.);
- problems and danger points such as: surface of the path/track/lane (smoothness, holes, steps);
- lighting;
- need for racks and bicycle parking;
- horizontal signing problems.

At the end of the analytical phase, a new directional signing proposal was devised, aiming at:

- signs positioning;
- signs specific features (size and placing);
- signs function (direction signing or Road Code signing).

Surveys were elaborated in accordance with:

- ✓ Guidelines from FIAB (Italian Federation bicycles' friends) regarding direction signing for cyclists; direction signing in the Highway Code.
- ✓ “Best practices” in the signing system: in recent years some countries have introduced good signing systems for cyclists, especially Denmark and Switzerland.

A brief analysis of the state of the art of signing in Italy with some examples of best practices (the case of Bolzano) was done; the FIAB (Italian Bicycle Friends Federation) proposal about signing for cyclists was gathered and the features of the new direction sign were designed.



Fig. 4: the photo reportage of the inspection along itinerary n. 3

ID	DESCRIZIONE	SINISTRALE				DESTRALE				SINISTRALE PRECONIZATA	NOTE	
		1	2	3	4	1	2	3	4			
1	avanzata											
2	avanzata											
3	avanzata											
4	avanzata											
5	avanzata											
6	avanzata											
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34	avanzata											
35	avanzata											
36	avanzata											
37	avanzata											
38	avanzata											
39	avanzata											
40	avanzata											

Fig. 5: The “abacus” of the signs: for each itinerary the abacus of road signs was set up

### B3 Situation before CIVITAS

The Cycle Mobility Plan elaborated in 2000 (within the 1998 Urban Transport Plan) aimed at realizing almost exclusively new cycle lane kms in order to favor the implementation of long and safe cycle routes for its citizens.

Before Civitas project and before ,the new Cycle Mobility Plan (approved in 2011 together with the new General Master Plan of Brescia adoption – PGT) no attention had been given to the renewal of the existing cycle routs and to their quality. This had led to a progressive worsening of the infrastructures and to a progressive lack of itineraries integration, with a consequent decreasing of the cyclists’

comfort and of the perceived safety. Furthermore no systematic and targeted dissemination activities had been carried out by the Municipality, except for publication of info on the Municipality web site.

## **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Design of the signs for the cycle lanes** (from October 2008 to October 2010) – This stage consisted of the necessary analysis of the general situation of signing for cycling in Italy and Europe, in order to define the best practices to be used. In particular the following cases were studied:

- ✓ the Danish signing system for cyclists in Europe;
- ✓ the FIAB (Italian Federation of Bicycle Friends) contribute on the theme of signing;
- ✓ the experience of Bolzano in Italy;



Fig. 6: CITY INVESTIGATION - need of horizontal and vertical signs

The activity consisted in cycle route inspection to define location, size and function of the new signals, and cycle parking demand. The cycle itineraries (tracks and lanes) were explored by the technicians and the cyclist's association in order to identify the dangerous points (intersections/interruptions/need of horizontal and vertical signing) (Fig. 6, Fig. 7).



Fig. 7: Schedules related to itineraries and to specific weak points existing along the itineraries

At the end of the analytical phase (Fig. 8), a new directional signing proposal was designed, including:

- signs positioning;
- signs specific features (size and placing);
- signs function (direction signing or Road Code signing).

Finally, a Deliverable document was elaborated in order to define the adopted methodology and the technical features of the different installations foreseen in this measure implementation, that were useful for the tender made to implement the measure successfully.

ABACO ITINERARIO N° 9 (OSPEDALE CIVILE - URAGO MELLA)		SEGNALETICA VERTICALE DA CODICE						CARTELLI D'INDICAZIONE	CARTELLI DI CONFERMA DEL PERCORSO	SEGNALETICA ORIZZONTALE	NOTE	
												
		diam. 60 cm	40 cm X 60 cm	15 cm X 35 cm								
II	<b>LOCALIZZAZIONE</b>											
ITINERARIO 9 (direz. Ospedale - Urugo)	1	via Tosoni	1					1	CI1			
	2	p.le Corvi						1	CI2			
	3	via Zadei									corsia mista buserbicitaxi	
	5	via Zadei - via Trento							1	CC1	semaforo a chiamata per bici	
	6	via Zadei - via Altipiani d'Asiago									cartello di fermata obbligatoria "STOP"	
	7	via Zadei - Via Filizi							1	CC2		
	8	via Gamba - via San Donino						1	CI3			
	9	via San Donino									modifica tracciato per spostamento attraversamento ciclabile	
	10	via San Bartolomeo							1	CC3		
	11	via Corridoni - via Carnia							1	CC4		
	12	via Reverberi							1	CC5	attraversamento ciclabile	
	13	via Oberdan						1	CI4	1	CC6	presenza di gradino
	14	via Risorgimento						1	CI5			
	15	via Risorgimento - via Don Vender						1	CI6	1	CC7	simbolo bici
	16	via Risorgimento		1								
	ITINERARIO 9 (direz. Urugo - Ospedale)	21	via Risorgimento - via Lodrini	1					1	CI7		
22		via Risorgimento - via Fornasini	1									
23		via Risorgimento - via Collebeato						1	CI8			
24		via Risorgimento - via Oberdan						1	CI9			
25		via Oberdan						1	CI10	1	CC8	
26		via Oberdan								1	CC9	
27		via Corridoni - via Reverberi								1	CC10	
28		Via San Donino - via San Bartolomeo								1	CC11	
29		via San Donino								1	CC12	
30		via San Donino - via Gamba						1	CI11			
31		via Zadei				1						
32		p.le Corvi						1	CI12			

Fig. 8: The “abacus” of the signs: for each itinerary the abacus of road signs was set up

**Stage 2: Tender** (from October 2009 to October 2010) – The activities implemented in this task regarded:

- ✓ subscription of a contract with the company in charge of the whole project;
- ✓ approval of the executive projects for the realization of the works;
- ✓ support to the works execution;
- ✓ site inspection with the company in charge of the works in order to verify the new signs positioning;
- ✓ site inspection with the company in charge of the works in order to verify the rack positioning.

The document “Verbale di procedura negoziata” assigned the project to “EUROSTRADE” company (ref. Municipality of Brescia Determ. N. 923 - 12-04-2010 N. 20711 P.G.).

**Stage 3: Installation of the new signs and racks and system running** (from October 2009 to October 2012) – The works were divided into 2 “lots” of implementation. The updating of the Cycle Mobility Plan caused slight delay in the definition and execution of the interventions. During Civitas project, the following activities were implemented:

- ✓ 95 Km of renewed bicycle lanes/tracks
- ✓ n. 1238 installed cycle parking slots - “pentalock” + “verona” types - It’s important to underline that the number of installed cycle parking slots doesn’t equal the number of racks, as a rack is composed by several cycle slots.
- ✓ n.450 direction signs (horizontal and vertical signs) positioned
- ✓ n.5.000 cycle maps distributed in September 2010 to inform people about the renewed bicycle itineraries and the improvement of the bike-parking areas.

Furthermore in October 2012 “new information maps” were targeted to cycle users and contain practical information concerning existing services along the itineraries such as accommodation, restaurants, bicycle repairs, etc. including also the new metro line (start up foreseen by 2013) and bike sharing service locations.



**Fig. 9: FINAL PROJECT Installation of the designed new signs**



**Fig. 10: FINAL PROJECT Series of signs installed along itinerary n. 9**

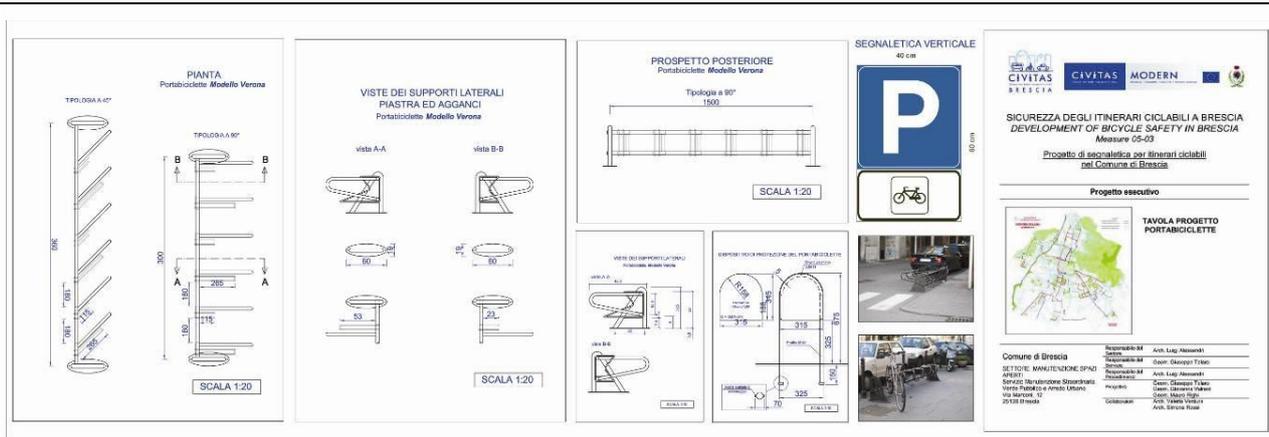


Fig. 11: FINAL PROJECT The project and some example of the cycle racks installed



Fig. 12: FINAL PROJECT The cycle racks for the city center (Pentalock model)

**Stage 4: Training of the actors** (from June 2009 to October 2011) – During this period Municipality technicians, working in the involved departments, were trained through the participation to the activities related to the Cycle Mobility Plan (meetings, elaboration of the Plan itself, etc...) and to periodic meetings about the cycle safety project.

## B5 Inter-relationships with other measures

This measure was related to:

- M05.02 “Accident risk analysis and development of road safety” that foresaw the localization of road accidents (also bicycle one’s) within the territorial boundaries of Brescia Municipality. In this measure (M.5.03 “Development of bicycle safety in Brescia”) indicators related to safety along bicycle itineraries were based on the data collected in M. 5.02 “Accident risk analysis and development of road safety”
- M.04.06 “Mobility management actions in Brescia” that foresaw bike tagging actions in order to reduce thefts this measure (M.5.03 “Development of bicycle safety in Brescia”) indicator related to bicycle thefts was based on the data collected in M.04.06 “Mobility management actions in Brescia”

## C. Evaluation – methodology and results

From the evaluation point of view the main objective of the measure consisted in improving the quality of cycling itineraries. Moreover, the measure aimed at improving bicycle services and preventing bicycle thefts increasing bicycle parking areas equipping them with lockable racks;

### C1 Measurement methodology

The selected indicators are almost all main indicators, able to evaluate measure efficiency in terms of objectives achievement.

Among the selected indicators:

- n. 2 “Cyclist death/total VRUs involved in road accidents”
- n.3 “Cyclist injured/total VRUs involved in road accident”

were collected using data coming from database implemented in M05.02 “Accident risk analysis and development of a road safety”.

Indicator n. 1 “Injuries and deaths caused by transport accidents” can be considered a complementary indicator as it measures general information in relation to road safety.

Indicator n.7 “N of bicycle thefts of tag bicycles in a given period” can be considered a complementary indicator in order to support the evaluation of the “locking racks” effectiveness together with the general (estimated) data on bicycle thefts in Brescia (2007-2011).

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Transport safety	Injuries and deaths caused by transport accidents	ISTAT road accident data; Local Police and Regional database	Complementary Indicator data coming from database implemented in M05.02 First data collection after the OP: 2010
2	Transport safety	Cyclist death/total VRUs involved in road accidents	ISTAT road accident data; Local Police and Regional database	Main Indicator data coming from database implemented in M05.02 First data collection after the OP: 2010
3	Transport safety	Cyclist injured/total VRUs involved in road accident	ISTAT road accident data; Local Police and Regional database	Main Indicator data coming from database implemented in M05.02 First data collection after the OP: 2010

4	Quality of service	% increase of cycle parking in a given period	Cycle parking count in the city center	Main Indicator First data collection after the OP: 2010
5	Quality of service	Bicycle km in renewed lanes tracks/ total bicycle kms	Cycle itineraries network length	Main Indicator First data collection after the OP: December 2011
6	Awareness	Awareness level	CBS Questionnaire	Main Indicator First data collection after the OP: April 2011
7	Society	N of bicycle thefts of tag bicycles in a given period	Data provided by the National tagged bikes register	Complementary Indicator First data collection after the OP: 2010
8	Awareness	Cycle maps distributed/ maps published	Map count	Main Indicator First data collection after the OP: September 2010

Detailed description of the indicator methodologies:

- **Indicator 1** (*INJURIES AND DEATHS CAUSED BY TRANSPORT ACCIDENTS*) - This indicator was calculated every year, when the new road accidents data arrive (data coming from ISTAT, Local Police and Regional database).
- **Indicator 2** (*RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS*) – Using data coming from ISTAT, Local Police and Regional database it was possible to extract data concerning only accidents involving dead cyclists and total involved VRUs. (VRUs = pedestrians + cyclists). This indicator was also scheduled for the M05.02 “*Accident risk analysis and development of a Road Safety Monitoring centre in Brescia*”.
- **Indicator 3** (*RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS*) – Using data coming from ISTAT, Local Police and Regional database it was possible to extract data concerning only accidents involving injured cyclists and total involved VRUs. This indicator was also scheduled for the M05.02 “*Accident risk analysis and development of a Road Safety Monitoring centre in Brescia*”.
- **Indicator 4** (*% INCREASE OF CYCLE PARKING IN A GIVEN PERIOD*) – Starting from a bike parking census in the city center of Brescia, the ex ante situation of this indicator was up to December 2009. It’s important to highlight that Bicimia (Bike sharing) and “Bicistazione” bike parking were not counted because they were addressed to specific target users (subscribers).
- **Indicator 5** (*BICYCLE KM IN RENEWED LANES TRACKS/ TOTAL BICYCLE KMS*) – This indicator showed the bicycle network total length.
- **Indicator 6** (*AWARENESS LEVEL*) – This indicator was measured through the administration of a questionnaire. The questionnaire was the same used for the acquisition of indicators belonging to other Brescia Municipality measures (M05.02, M06.05 and M04.06).

The questions included in the questionnaire, able to express the indicator “Awareness level” were the following:

“Do you know that, within CIVITAS project, Municipality of Brescia wants to requalify all the cycle itineraries installing new clear directional, horizontal and vertical signs and increasing the number of cycle racks? YES/NO”

“Do you know that it’s possible to tag your bike (registering it into a National Register) in order to increase, in case of theft, the possibilities to find it?” The possible answers were: 1. Yes, but my bike hasn’t been tagged yet; 2. Yes and my bike has already been tagged; 3. Yes but I’m not interested/Don’t think it would be useful; 4. No but I’m interested; 5. No and I’m not interested.

- **Indicator 7 (N OF BICYCLE THEFTS OF TAG BICYCLES IN A GIVEN PERIOD)** – The required information about tagged bike thefts was collected by the National tagged by register, managed by FIAB (Italian Association of Bicycle Friends).
- **Indicator 8 (CYCLE MAPS DISTRIBUTED/MAPS PUBLISHED)** - This indicator was measured using data referred to the cycle maps printed and distributed.

### C1.2 Establishing a Baseline

Year 2009 was taken as reference for the establishing of the baseline for the indicators concerning the cycle itineraries requalification and the road safety statistics, as the results of the cycle lanes extension (up to the beginning of Civitas) were tangible in 2009. In Brescia the first Cycle Mobility Plan was elaborated in 2000 and it scheduled, almost exclusively, the realization of new cycle itineraries. Before 2009 no requalification activity was carried out, except the ordinary maintenance.

Indicators concerning the cycle itineraries requalification	BASELINE (2009)
4. Cycle parking in a given time period	downtown 498
5. Bicycle kms in renewed lanes tracks/ total bicycle kms	0 renewed km/119 km
6. Awareness level about cycle itineraries requalification: (questionnaire April 2010)	Awareness level 16,25 %
Table 1: Indicators concerning the cycle itineraries requalification	

The same baseline was set for the indicators concerning road safety.

Indicators concerning road safety statistics	BASELINE (2009)
1. Injuries and deaths caused by transport accidents	Injuries = 1267 Deaths = 14
2. Cyclist death/total VRUs involved in road accidents	0,004
3. Cyclist injured/total VRUs involved in road accident	0,47
Table 2: Indicators concerning road safety statistics	

Also for the last two indicators the same baseline can be assumed.

Other indicators	BASELINE (2009)
8) Cycle maps distributed/ maps published	0 maps distributed/ 5000 maps published = 0%
7) Tagged bicycle thefts in a given period	10
Table 3: Other indicators	

### C1.3 Building the Business-as-Usual scenario

Since 2000 the city of Brescia has developed cycle itineraries, and it has reached one of the top positions for what concerns km of cycle routes.

The graph below shows the realization of the cycle lanes in Brescia before the beginning of the Civitas project.

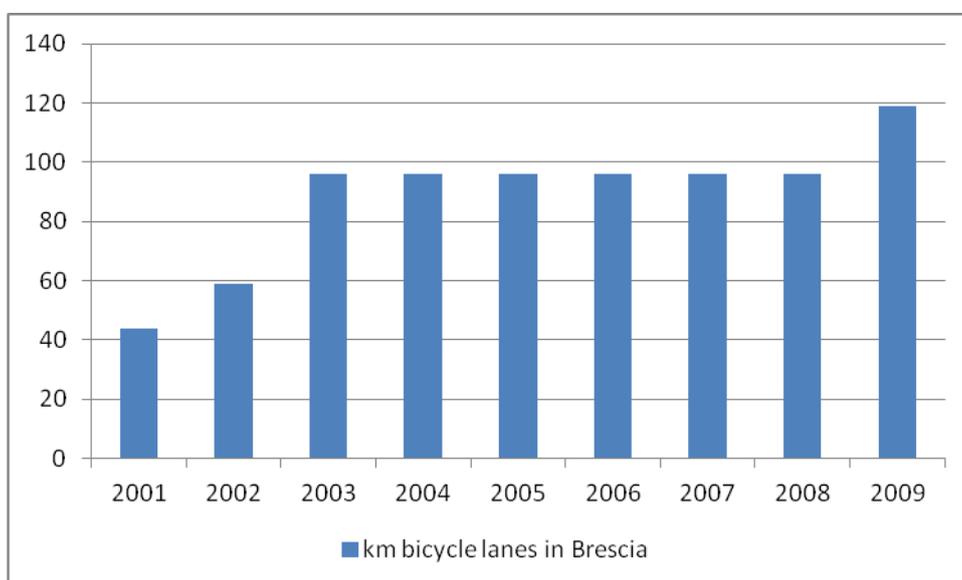


Fig. 13: Extension of the bicycle paths in Brescia before Civitas

The Cycle Mobility Plan elaborated in 2000 (within the 1998 Urban Transport Plan) aimed at realizing almost exclusively new cycle lane kms.

As already mentioned before Civitas project and before the New Cycle Mobility Plan (approved in 2011 together with the new General Master Plan of Brescia adoption – PGT) no attention had been given to the renewal of the existing cycle routes and to their quality.

The Civitas effects consisted in developing integrated activities on cycling such as renewal of cycle paths, equipment and providing information of cycle network to citizens. Integrated managing was needed to achieve these goals. Such cooperation led to a New Cycle Mobility Plan.

Starting from the baseline illustrated in the previous paragraph, the BaU scenario was built both in qualitative/quantitative terms.

In order to build the BAU for several indicators specific methodological assumptions were made and only for indicators concerning road safety statistics projection of historical data series was done.

As regard ind. 4 “Cycle parking downtown in a given time period” it was probable that no new parking would have been realized, therefore the BaU value equaled the baseline one.

As regard ind. 5 “Bicycle kms in renewed lanes tracks/ total bicycle kms”, without the Civitas contribution, the extension would have been carried out but without any requalification of the existing ones (see graph 14)..Therefore, the BaU value for this indicator was 0.

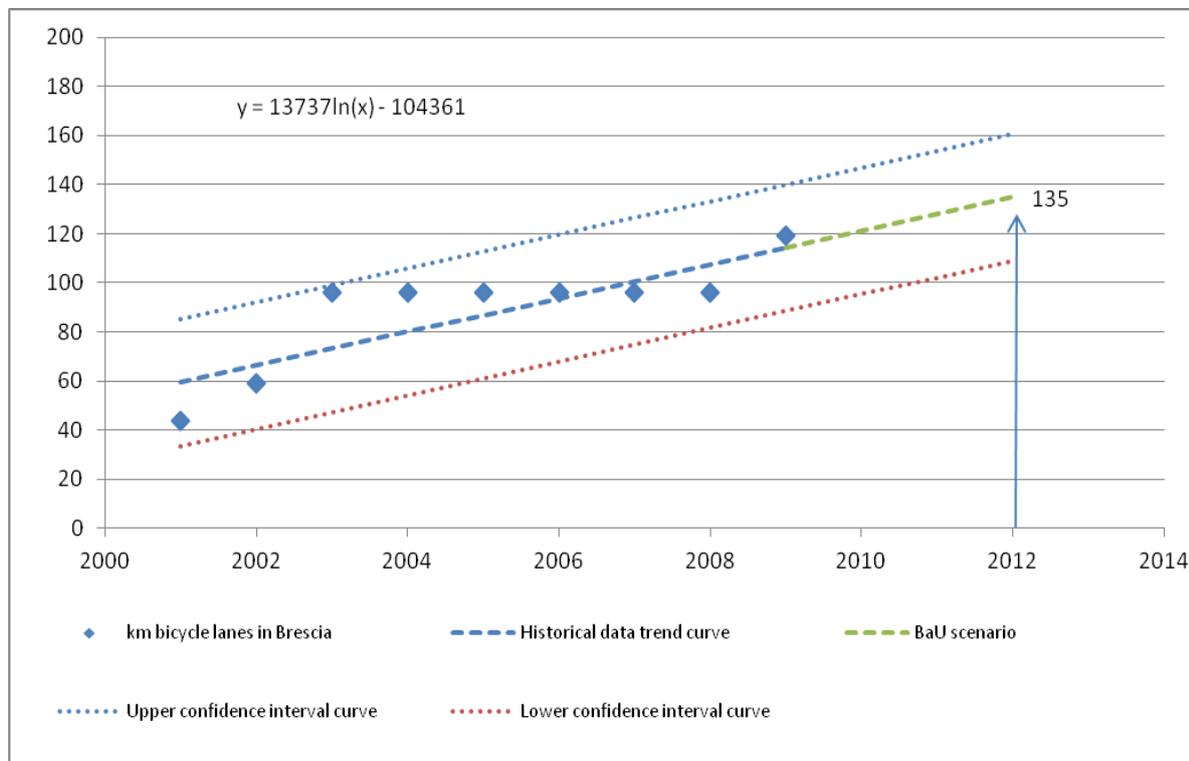


Fig. 14: Extension (without requalification) of the cycle network

The indicator n. 6 “Awareness level about the requalification of the cycle itineraries” had no historical data series and the BaU value equaled the baseline situation.

Indicators concerning the cycle itineraries requalification	BaU (2012)
4) Cycle parking in a given time period	downtown = 498
5) Bicycle kms in renewed lanes tracks/ total bicycle kms	Renewed kms = 0
6) Awareness level (about the requalification of the cycle itineraries)	16,25%
Table 4: Indicators concerning the cycle itineraries requalification	

As regard indicator 8 “Cycle maps distributed/maps published”, the distribution of cycle maps had never been a regular activity, except some extraordinary events.

Therefore the BaU value for this indicator equaled 0, as likely no new cycle map would have been printed.

For the indicator n.7 “Tagged bicycle thefts in a given period” the historical data series available (3 years) was not sufficient for the projection of a reliable trend curve.

Therefore the BaU value equaled the average value of the available ex ante data, This assumption is coherent with the general consideration that the bike tagging is able to have a deterrent effect against the bike theft.

Other indicators	BaU (2012)
8. Cycle maps distributed/ maps published	0
7. Tagged bicycle thefts in a given period	15
Table 6: Other indicators	

For the indicators concerning road safety statistics, the BaU scenario was obtained keeping the baseline values or projecting the historical data series.

ind. 1. “Injuries and deaths caused by transport accidents”

This indicator was set as complementary, because it represented the overall road traffic accidents trend in the city of Brescia. The measure wasn’t able to affect it significantly, as it consisted in actions addressed to cyclists and as everybody knows in Italy the main transport mode in urban area is represented by cars. Therefore the BaU values equal the baseline ones (injuries 1267; deaths 14).

Year	Injuries in road accidents	Deaths in road accident
2005	3606	22
2006	3302	20
2007	3320	30
2008	1455	13
2009	1267	14
Tab. 7: Injuries and deaths caused by transport accidents		

Indicator 2 “Cyclist death/total VRUs involved in road accidents” and Indicator 3 “Cyclist injured/total VRUs involved in road accident” were the result of the historical data series projections and underline a slight increasing trend in cycle death in relation to other VRUs in general and a slight decreasing trend in injured cyclists.

Ind. 2. “Cyclist death/total VRUs involved in road accidents”

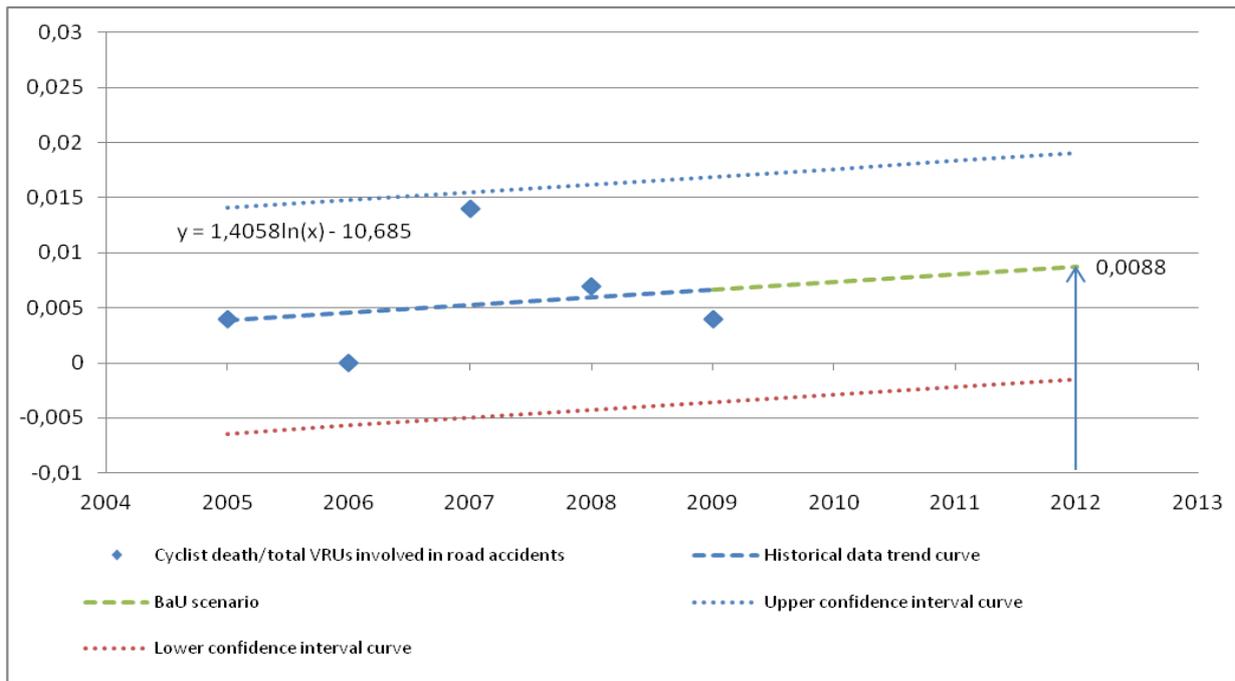


Fig. 15: Cyclist death/total VRUs involved in road accidents

Ind. 3. “Cyclist injured/total VRUs involved in road accident”

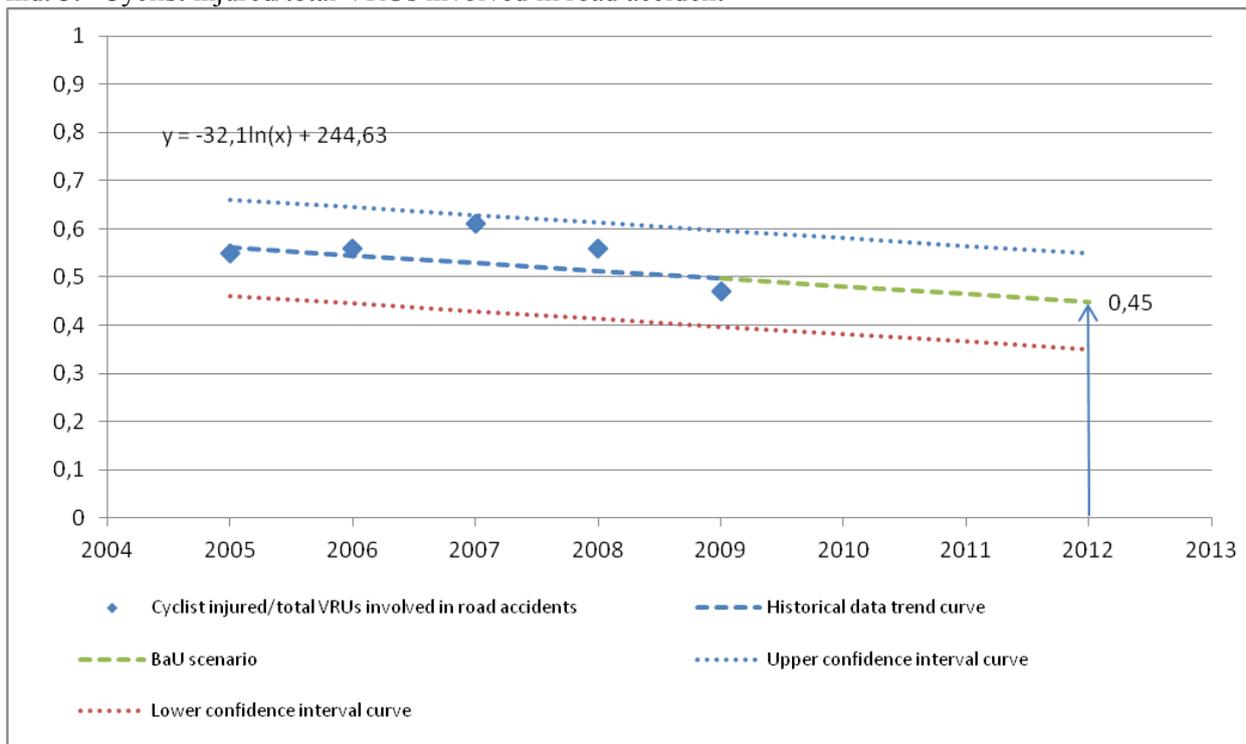


Fig. 16: Cyclist injured/total VRUs involved in road accident

Indicators concerning road safety statistics	BaU (2012)
1. Injuries and deaths caused by transport accidents	Injuries = 1267

	Deaths = 14
2. Cyclist death/total VRUs involved in road accidents	0,0088
3. Cyclist injured/total VRUs involved in road accident	0,45

Table 8: Indicators concerning road safety statistics

## C2 Measure results

The results were presented under sub headings corresponding to the areas used for indicators – Transport and Society.

### C2.1 Transport

Table C2.1.1: Measure results for the indicators of the category “Transport”

Indicator	Before (Year 2009)	After (variable)	B-a-U (Year 2010)	Difference: After –Before	Difference: After – B-a-U
1) Injuries and deaths caused by transport accidents	<b>Year 2009:</b> deaths=14 injuries=1267	<b>Year 2010:</b> deaths=6 injuries=1421	<b>Year 2010:</b> Deaths = 14 Injuries = 1267	Deaths = -8 Injuries = +154	Deaths = -8 Injuries = +154
2) Cyclist death/total VRUs involved in road accidents	0,004 (From ISTAT)	Year 2010: 0,00	Year 2010: 0,0074	-0,004	-0,0074
		Year 2011: (not available)	Year 2011: 0,0081	Not Assessable	Not Assessable
	0,00 (Local Police)	Year 2010: 0,00	Year 2010: 0,00	0,00	0,00
		Year 2011: 0,008	Year 2011: 0,00	0,008	0,008
3) Cyclist injured/total VRUs involved in road accidents  <b>Proportion=I/LP = 0,94</b>	0,47 (From ISTAT)	Year 2010: 0,47	Year 2010: 0,48	0,00	-0,01
		Year 2011: (not available)	Year 2011: 0,46	Not Assessable	Not Assessable
	0,50 (Local Police)	Year 2010: 0,50	Year 2010: 0,45	0,00	0,05
		Year 2011: (not available)	Year 2011: 0,43	Not Assessable	Not Assessable
4) cycle parking	<b>In 2009, 968 bike</b>	<b>In 2010, 990 bike</b>	498	+22	+492

Indicator	Before (Year 2009)	After (variable)	B-a-U (Year 2010)	Difference: After –Before	Difference: After – B-a-U
slots in a given period	parking slots of which 498 in downtown (of which 130 “Verona” model) and others various models.	parking (of which 22 are new pentaloaks and others various models)			
		<b>In 2011</b> , 1098 bike parking (of which 258 are new Verona model and others various models)	498	+132	+600
5) Bicycle km in renewed lanes tracks/ total bicycle kms	existing cycle network up to <b>December 2009</b> is 0/119 km=0	<b>(December 2011)</b> 65/119 km=0,55	0%	+55%	+55%
		<b>(June 2012)</b> 95/119 km=0,80	0%	+80%	+80%

It's important to underline that in Brescia the number of accidents and injured people (complementary indicator 1 “Injuries and deaths caused by transport accidents”) increased from 2009 to 2010, while at national level in the same period the opposite trend was observed.

At the same time in Brescia the crash severity decreased (the number of deaths goes from 14 in 2009 to 6 in 2010 (as expressed by the same indicator 1), which means that more accidents occurred but they were less serious.

Another important consideration regards data availability. The more complete and official road accidents data comes from the Italian National Institute of Statistics (ISTAT), but their late delivery to the city of Brescia makes the most recent year data collection not possible. For this reason, the partial data came from the Municipal Police (which was one of the police force, together with Carabinieri, Road Police and Province Police, that intervene when a road accident occur to write up the minutes). Municipal Police collected the most part of the road accidents occurring in urban areas, where vulnerable road users were most involved.

Observing both the partial data coming from the Municipal Police and the ISTAT ones (even if the scarce availability of data referred to 2-3 years doesn't allow to make any significant statistical considerations) the number of cyclists dead or injured on roads decreased or registered a stable trend, as it's possible to see for indicators n. 2 “Cyclist death/total VRUs involved in road accidents” and 3 “Cyclist injured/total VRUs involved in road accidents”

The results obtained for indicators n.4 “Cycle parking in a given period” and n.5 “Bicycle kms in renewed lanes tracks/total bicycle kms”, highlighted the effectiveness of the actions concerning the improvement of cycling equipment, which was one of the measure objectives. Within the end of the Civitas Project, not all the existing cycling network were likely renewed, because some slight delays were experienced mainly in relation to the metro line building sites.

## C2.2 Society

**Table C2.2.1: Measure results for the indicators of the category “Society”**

Indicator	Before	After	B-a-U	Difference: After –Before	Difference: After –BaU
6) Awareness level	<b>March 2010</b> - Awareness level about cycle itineraries requalification: 16,25 %  - Awareness level about bike tag initiative: 20,00 %	<b>April 2011</b> - Awareness level about cycle itineraries requalification: 19,00 %  - Awareness level about bike tag initiative: 35,00 %	<b>April 2011</b> Awareness level about cycle itineraries requalification: 16,25%	+2,75%	+2,75%
		<b>April 2012</b> - Awareness level about cycle itineraries requalification: 21,00 %  - Awareness level about bike tag initiative: 39,00 %	<b>April 2012</b> Awareness level about cycle itineraries requalification: 16,25%	+3,75%  +19,0%	+4,75%
7) N of bicycle thefts of tagged bicycles in a given period	<b>Year 2009:</b> 10	<b>Year 2010:</b> 9	<b>Year 2010:</b> 15	- 1	- 6
8) Cycle maps distributed/ maps published	0/5000 = 0%  (The ex ante period is up to December <b>2009</b> . The total amount of published maps are 5000. No maps are distributed)	<b>September 2010:</b> 5000/5000 = 100%	0%	+100%	+100%

The complementary indicator 7 “N of bicycle thefts of tag bicycles in a given period” together with the general data on the estimated number of circulating bicycles in Brescia - about 15.000 – and relative thefts (2007-2011) gives an idea of the importance of installing locking racks in Brescia as it’s evident in the table reported below (see tab 9 - Bicycle thefts in Brescia ).

Furthermore, it’s evident that thefts are a security issue that cannot be faced without a strong security policy for the city and that such issue cannot be managed only from a technical point of view (for example installing lockable cycle racks).

YEARS	2007	2008	2009	2010	2011
Number of bicycle thefts in Brescia	1.800	1.800	1.800	1.800	2.250
% of bicycle thefts in Brescia on the estimated number of circulating bicycles (about 15.000)	12%	12%	12%	12%	15%

tab 9 - Bicycle thefts in Brescia

Souce: BiciSicura – Easy tag division of Easy trust srl (27/01/2012)

Indicator 6 “Awareness level” attested an increasing awareness among citizens either about the possibility of the bike tagging (+19,0%) and about the cycle itineraries renewal (from 16,25% in 2010 to 21,00% in 2012, with an increase of 4,75%).

As regards indicator n.8 “Cycle maps distributed/maps published”, it’s important to underline that, when the materials were printed or published, the distribution was widespread.

Indicators 6 and 8 made evidence of the positive effect of the cycle routes renewal and the well acceptance of this intervention. The growing of awareness level underlined also that the “demo activities” carried out during the measure contributed to the Cycle Mobility Plan success.

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	<p>To improve the quality of cycling itineraries (100 km of bicycle lanes) through signing (better cyclists' understanding of direction). i.e. implementation of the new signing system (170 signs) along 13 itineraries</p> <p><i>The results obtained for indicator n.5 “Bicycle kms in renewed lanes tracks/total bicycle kms”, highlighted the achievement of the measure objective. Not all the existing cycling routes were renewed, because some slight delays were experienced mainly in relation to the metro line building sites, and more than the scheduled 170 signs - both horizontal and vertical - were installed.</i></p> <p><i>Ind. 5 “bicycle Km in renewed lanes tracks/total bicycle Km”:</i>  <i>Before (year 2009) = 0/119 = 0%</i>  <i>After (year 2012) = 95/119 = 80%</i></p> <p><i>Alongside this, the success of the activity promoted by the measure was underlined by people who answered the questionnaires concerning the awareness level about cycle itineraries renewal (ind. 6 “Awareness level”) registering an increase of 4,75%.</i></p> <p><i>Ind. 6 “Awareness level”:</i>  <i>March 2010 (before)= 16,25%</i>  <i>April 2012 (after)= 21,00%</i></p>	**
2	<p>To improve information of possible itineraries trough the publication and distribution of 5.000 cycle maps</p> <p><i>This objective can be considered exceeded, as a matter of fact, the distribution was completed.</i></p> <p><i>The indicator able to express this achievement is the following:</i>  <i>ind. 8 (Cycle maps distributed/ maps published)</i>  <i>Before (2009) = 0</i>  <i>After (2010) = 5000/5000 = 100%</i></p>	***
3	<p>To improve bicycles services (mainly through the installation of locking racks and/or parking slots) increasing the bicycle parking areas (up to 35%), with the installation and location of 120 lockable racks</p>	**

	<p><i>This objective can be considered achieved in full, as the cycle parking area was increased and new cycle racks were installed: respect to the 120 planned racks 1098 slots were realized (considering that each rack is composed by a variable number of slots)</i></p> <p><i>The improvement of the services to cyclists was made through the installation of cycle racks along the cycle itineraries and downtown.</i></p> <p><i>Indicator n. 4 “% increase of cycle parking in a given period”: Before (year 2009) = 968 bike slots After (year 2012) = 1098 bike slots</i></p>													
<p><b>4</b></p>	<p>Improvement of cyclists’ safety through cycle routes renewal and accidents/victims reduction (20%)</p> <p><i>Bicyclists’ safety was expressed by the indicators n.2 “Cyclist death/total VRUs involved in road accidents” and n.3 “Cyclist injured/total VRUs involved in road accidents”.</i></p> <p><i>Indicator n. 2 “Cyclist death/total VRUs involved in road accidents”:</i></p> <table border="0"> <tr> <td><i>Istat data</i></td> <td><i>Local Police data</i></td> </tr> <tr> <td><i>Before (year 2009) = 0,004</i></td> <td><i>Before (year 2009) = 0,00</i></td> </tr> <tr> <td><i>After (year 2010) = 0,00</i></td> <td><i>After (year 2011) = 0,008</i></td> </tr> </table> <p><i>Indicator n. 3 “Cyclist injured/total VRUs involved in road accidents”:</i></p> <table border="0"> <tr> <td><i>Istat data</i></td> <td><i>Local Police data</i></td> </tr> <tr> <td><i>Before (year 2009) = 0,47</i></td> <td><i>Before (year 2009) = 0,50</i></td> </tr> <tr> <td><i>After (year 2010) =0,47</i></td> <td><i>After (year 2010) = 0,50</i></td> </tr> </table> <p><i>Observing both the partial data coming from the Municipal Police and the ISTAT ones the number of cyclists dead or injured on roads slightly decreased or registered a stable trend. It’s important to highlight that in general Brescia registered in the period 2009-2010 an increasing number of accidents and injured people, but at the same time a decrease of the number of dead people and of the road accident severity (indicator n. 1 “Injuries and deaths caused by transport accidents”).</i></p> <p><i>Indicator n. 1 “Injuries and deaths caused by transport accidents” Before (year 2009): deaths=14; injuries=1267; After (year 2010): deaths=6; injuries=1421.</i></p>	<i>Istat data</i>	<i>Local Police data</i>	<i>Before (year 2009) = 0,004</i>	<i>Before (year 2009) = 0,00</i>	<i>After (year 2010) = 0,00</i>	<i>After (year 2011) = 0,008</i>	<i>Istat data</i>	<i>Local Police data</i>	<i>Before (year 2009) = 0,47</i>	<i>Before (year 2009) = 0,50</i>	<i>After (year 2010) =0,47</i>	<i>After (year 2010) = 0,50</i>	<p><b>*</b></p>
<i>Istat data</i>	<i>Local Police data</i>													
<i>Before (year 2009) = 0,004</i>	<i>Before (year 2009) = 0,00</i>													
<i>After (year 2010) = 0,00</i>	<i>After (year 2011) = 0,008</i>													
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<i>After (year 2010) =0,47</i>	<i>After (year 2010) = 0,50</i>													
<p><b>5</b></p>	<p>Bicycles thefts prevention increasing the bicycle parking slots</p> <p><i>The objective of reducing cycles thefts through technical solution such as the lockable racks is not so easily assessable, as security topics are usually faced with transversal and specific policies developed at city level.</i></p> <p><i>Therefore, even if a specific indicator was selected to monitor the number of tagged bicycles theft (indicator n.7 “N of bicycle thefts of tag bicycle in a given period”), and even if anti-theft parking slots systems were installed (see target achievement number 3), and results are available from a quantitative point of view, this objective cannot be considered assessable.</i></p> <p><i>Ind. 7 (N of bicycle thefts of tag bicycle in a given period).</i></p>	<p><b>NA</b></p>												

<i>Before (year 2009) = 10</i>	
<i>After (year 2010) = 9</i>	
<b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b> <b>** = Achieved in full    *** = Exceeded</b>	

## C4 Up-scaling of results

For this Measure is not possible to forecast an up scaling of the results, as it was already dedicated to the whole city. The elaboration of a Cycle Mobility Plan for the city is an up-scaling of the measure implementation. The analysis of the cycle network quality and the renewal of some specific cycle routes, undertaken during Civitas, were a fundamental starting point for the elaboration of the Cycle Mobility Plan, which extended the renewal planning activities to the whole cycle network.

## C5 Appraisal of evaluation approach

The evaluation approach firstly considered project's objectives as expressed explicitly in the original evaluation plan. The data collection methodology and the data quality were sufficient for the needs of technical evaluation of the measure.

The indicators selected at the beginning of Civitas project and the chosen ones belonged to the following categories: Transport and Society. In the first part, indicators were able to monitor the accidents recorded in the urban area, divided by the different mobility components, the extension of cycle lane and the number of bike parking.

One indicator (n 8 "Awareness level") belonged to the category Society, and aimed to provide the degree of population knowledge about cycle line requalification and about bike tag initiative. The bicycle thefts and maps distribution were also investigated.

## C6 Summary of evaluation results

The key results were as follows:

- **Key result 1** – renewal and upgrading of existing routes. Before the Civitas project and before the elaboration of the new General Master Plan of Brescia (PGT), the Cycle Mobility Plan (dated back to 2000) had never been updated and this brought to the progressive worsening of the infrastructures and of the itineraries continuity, the decreasing of the cyclists' comfort and the perceived safety. Without the Civitas contribution, the extension of the cycle network would have likely done anyway, but the renewal of the deteriorated routes wouldn't have been done, except the ordinary interventions (such as horizontal signs, cycle lanes delimitations, etc.);
- **Key result 2** – The main objective of the measure (the renewal of cycle routes mainly through the installation of a new signs system) was fully achieved, as more signs (both horizontal and vertical) than the planned ones were installed;
- **Key result 3** –in May 2011, in order to coordinate, at technical level, all the cycling activities, the Cycle Mobility Office was instituted. This office coordinates the works about cycling among different Municipal Office Departments (Traffic and Mobility, Urban Planning, Public Spaces, Signing etc.) and represents a point of reference for the local cyclists' association. This office can be considered the result of a new sensibility of the Municipality to cycling, moreover as a consequence of the participation on Civitas Project.

## C7 Future activities relating to the measure

Cycle Mobility Plan implementation.

Focus on secondary (East – West) cycle routs development creating a friendly environment for cyclists in residential districts (such as S. Bartolomeo, Casazza, S.Polo).

## **D. Lessons learned**

### **D.0 Focused measure**

This measure is not a focused one.

### **D1 Deviations from the original plan**

The deviations from the original plan comprised:

**Deviation 1 Organizational – steps of implementation.** Both the design phases and the procurement and installation phases were sub-divided into three different steps. ML decided to split the tasks into two lots of implementation, in order to recover some delays occurred in the areas of the metro line road works.

### **D2 Barriers and drivers**

#### **D2.1 Barriers**

The following main barrier were experienced:

##### **Preparation phase:**

- **Involvement barrier: management of different municipality sectors** – Several Brescia Municipality departments were involved in cycle mobility topics A great effort was the necessary to co-ordinate actions to be carried out by the different sectors (Roads, Sign, Urban planning, Urban equipment), in order to install the proper road signs after infrastructural operations on cycle tracks and lanes.

##### **Implementation phase**

- **Operation barrier** – Some difficulties were experienced during the renewal of some of the planned routes, because of the metrobus road works. For this reason not all the planned cycle routes were renewed.

#### **D2.2 Drivers**

In the sequel, main drivers, which have been picked out during the measure implementation, are pointed out.

##### **Implementation/operation phase**

- **Political/strategic drivers: a new plan and a dedicated office** – The realization of the new Cycle Mobility Office and the approval of the Cycle Mobility Plan were fundamental drivers for the cycle routes renewal activities during the operation phase of the measure. The inclusion of the Cycle Mobility Plan in the General City Master Plan gave strength to the cycle mobility policies.

##### **Preparation phase**

- **Financial driver** – CIVITAS funding. From a strategic point of view, the availability of extra funding can be considered an important driver for infrastructure projects for cycling (new cycle routes and lanes and road works for safety improvement of the existing cycle network).

## D2.3 Activities

### Implementation/operation phase

During the implementation/operation phase of the measure the following main activities were undertaken:

- the Cycle Mobility Office was instituted in order to coordinate the works on cycling among different Municipal Office Departments (Traffic and Mobility, Urban Planning, Public Spaces, Signing etc.);
- the knowledge of the expertise of involved technicians allowed a better distribution of the tasks among the people;
- the local association of cyclists (FIAB) was involved in the city investigation, supporting the technicians of the Municipality;
- frequent meetings with the involved technicians were organized to assess the status of the measure;
- activities were carried out in lots dividing the measure into two different implementation steps.

## D3 Participation

### D.3.1 Measure partners

The partners related to this measure were the following:

- the Departments of the Brescia Municipality involved in the cycle mobility planning and renewal (namely, Roads, Signs and Urban Equipment Dept, Urban Planning Dept and the Mobility and Traffic Dept);
- a local cyclists association (FIAB – Federazione Italiana Amici della Bici “Corrado Ponzanelli”) which was involved in the cycle routes investigation and in the detection of the most critic sites; and
- the company EUROSTRADE in charge of installing the new sign system along the renewed routes.

### D3.2 Participation of stakeholders

Alongside the citizens of Brescia, the main stakeholder category involved in the measure implementation is represented by the local cyclists association (FIAB – Federazione Italiana Amici della Bici “Corrado Ponzanelli”) which was involved in the cycle routes investigation. Their contribution in deepening the analysis carried out was fundamental for the cycle network renewal.

## D4 Recommendations

#### **D4.1 Recommendations: measure replication**

- **Recommendation 1 Collaboration** – The extremely positive experience of collaboration in cycle inspections and in draft designing and positioning the signals with the Italian Association of Cyclists (FIAB) can be easily transferred in other contexts.
- **Recommendation 2 Coordinate actions** – A dedicated Cycle Mobility Office was useful to coordinate actions among the several involved Departments and to improve the success of the measure. The experience of Brescia taught that the planning actions on the whole city can be driven by the experimental demo activities made on single sites: as a matter of fact, in Brescia the renewal activities were initially planned only for some cycle routes, then, extended to the whole city, including them into a Cycle Mobility Plan.

#### **D4.2 Recommendations: process**

- **Recommendation 1 Evaluation Real needs** – an in-depth investigation of the existing cycle network is fundamental to increase its quality. The involvement of the stakeholder, such as cyclists association, is crucial to understand users real needs.

## Annex 1: Historical data series for the BaU calculation

**Indicator 1 (INJURIES AND DEATHS CAUSED BY TRANSPORT ACCIDENTS).**

	Year				
	2005	2006	2007	2008	2009
Total deaths	22	20	30	13	14
Total injuries	3606	3302	3320	1455	1267

**Indicator 2 (RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)**

	Year				
	2005	2006	2007	2008	2009
Cyclist dead	1	0	4	2	1
Total VRUs involved	245	252	283	280	269
ratio	0,004	0,000	0,014	0,007	0,004
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	156	127

**Indicator 3 (RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS)**

	Year				
	2005	2006	2007	2008	2009
Cyclist injured	134	140	172	157	126
Total VRUs involved	245	252	283	280	269
ratio	0,55	0,56	0,61	0,56	0,47
Pedestrian involved	124	117	115	124	142
Cyclists involved	121	135	168	156	127

**Indicator 5 (BICYCLE KM IN RENEWED LANES TRACKS/ TOTAL BICYCLE KMS)**

	2001	2002	2003	2004	2005	2006	2007	2008	2009
km bicycle lanes in Brescia	44	59	96	96	96	96	96	96	119
km requalified bicycle lanes	0	0	0	0	0	0	0	0	0

**Indicator 7 (N OF BICYCLE THEFTS OF TAG BICYCLES IN A GIVEN PERIOD)**

	Year		
	2007	2008	2009
N. of tagged bikes theft	18	17	10

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1** (INJURIES AND DEATHS CAUSED BY TRANSPORT ACCIDENTS).

EX ANTE SITUATION (year 2009):

Total deaths=14

Total injuries=1267

- **Indicator 2** (RATIO BETWEEN THE NUMBER OF CYCLIST DEATHS AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS) – Using data coming from ISTAT, it’s possible to extract data concerning the only accidents involving dead cyclists and total involved VRUs. (VRUs = pedestrians + cyclists).

EX ANTE SITUATION: The ex ante situation of this indicator is referred to year 2009:

	2009
Cyclist dead	1
Total VRUs involved	269
Indicator n.2	0,004
Pedestrian involved	142
Cyclists involved	127

- **Indicator 3** (RATIO BETWEEN THE NUMBER OF CYCLIST INJURED AND THE TOTAL VRUS INVOLVED IN ROAD ACCIDENTS) – Using data coming from ISTAT, it’s possible to extract data concerning the only accidents involving injured cyclists and total involved VRUs.

EX ANTE SITUATION: The ex ante situation of this indicator is referred to year 2009:

	2009
Cyclist injured	126
Total VRUs involved	269
Indicator n.3	0,47
Pedestrian involved	142
Cyclists involved	127

- **Indicator 4** (% INCREASE OF CYCLE PARKING IN A GIVEN PERIOD) - It is considered the bike parking census in the city of Brescia. It’s important to highlight that Bicimia (*Bike sharing*) and “Bicistazione” bike parkings haven’t been counted.

EX ANTE SITUATION:

In 2009, **968 bike parking** were present, of which 130 “Verona” model, 18 and other various models (498 are located in downtown).

AFTER SITUATION:

In 2010, **990 bike parkings** were present, of which 22 are new pentaloeks and others are various models pre-existent.

In 2011, **1.230 bike parkings** are present, of which 240 are new “Verona” model and others are various models pre-existent.

- **Indicator 5 (BICYCLE KM IN RENEWED LANES TRACKS/ TOTAL BICYCLE KMS) –**

EX ANTE SITUATION: The ex ante situation of this indicator is up to December 2009 and shows the bicycle network total length.

The *existing cycle network up to December 2009 is 119 km*. At that date any requalification were made yet, except some cycle itineraries experimentally renewed, before the beginning of CIVITAS project, improving their accessibility and placing some vertical signs (via Flero and via Cadizzoni).

AFTER SITUATION: (year 2010)

Indicator 5= 50/119

AFTER SITUATION: (year 2011)

Indicator 5= 65/119

- **Indicator 6 (AWARENESS LEVEL) –** This indicator is measured through the administration of a questionnaire. The questionnaire is the same used for the acquisition of indicators belonging to other CBS measures (M05.02, M06.05 and M04.06). As explained in the M05.02 Evaluation Results Template, a survey based on face to face interviews would have required more time than the scheduled, to collect a significant ex-ante before the implementation of the measure, a faster procedure (that slightly differs from the initial one) has been chosen: the questionnaires have been administered by phone by a charged company. The representative sample has been chosen among the resident population (this choice is based on operative considerations: extending the survey also to the gravitating population would have introduced too many complications and would have increased the costs). The sample size, of 600 filled in questionnaires, can be selected among the personal data of the Municipality (this allows a statistical significancy of more than the 90%). To reach the goal of 600 filled in questionnaires, the company in charge of the survey contacted 787 families. Only 220 of them answered to the phone calls but thanks to the fact that families are generally composed by more than one members, are collected totally **601 filled in questionnaires**. The questionnaires have been administered **from 5<sup>th</sup> February to 3<sup>rd</sup> March 2010**. This period can be considered as a valid ex ante for this measure.

The question included in the questionnaire, able to express the indicator “Awareness level” is the following:

*“Do you know that, within CIVITAS project, Municipality of Brescia wants to requalify all the cycle itineraries installing new clear directional, horizontal and vertical signs and increasing the number of cycle racks? YES/NO”*

**EX ANTE SITUATION:** (Questionnaire of March 2010)

The calculated indicator is expressed by the percentage of people who has knowledge of a specific aspect respect to the total number of people who answered the questionnaire.

- Awareness level about cycle itineraries requalification: **16,25 %**

AFTER SITUATION: (Questionnaire of April 2011)

- Awareness level about cycle itineraries requalification: **19,00 %**

- **Indicator 7 (N OF BICYCLE THEFTS OF TAG BICYCLES IN A GIVEN PERIOD) –**

EX ANTE SITUATION: In order to collect the ex ante situation (referred to the year 2009) a FIAB representative have been contacted and provided the following value:

Indicator n.7=10

AFTER SITUATION: (Year 2010)

Indicator n.7=9

- **Indicator 8 (CYCLE MAPS DISTRIBUTED/ MAPS PUBLISHED) -** This indicator can be measured using data referred to the printing and distribution of cycle maps.

EX ANTE SITUATION: The ex ante period is up to December 2009.

The total amount of published maps are 5000: in particular, 2000 maps were printed in 2008 in occasion of the “Brescia una città sempre più verde” leaflet distribution; in September 2009 other 3000 maps (including cycle itineraries and municipal parks) were published.

No maps are distributed.

Indicators 8 =  $0/5000 = 0\%$

AFTER SITUATION:

Within September 2010 all the maps were distributed by means of the following dissemination channels: town Tourism Office, the Directorate of Civic Museums and the Open Spaces maintenance Department of Brescia Municipality.

Indicators 8 =  $5000/5000 = 100\%$

## **M06.02 – Executive summary**

This measure foresaw the start up of an “On demand transport system”, suitable for no-peak public transport demand, taking into account also the weakest users’ needs.

The existing “On demand” service is a manual on-demand transport system (“Accabus”) reserved for disabled people. This manual system isn’t able to optimize the resources.

In order to have a more efficient “on demand” service BST (public transport company in Brescia) decided to provide a technology that allows flexibility and trips optimization:

- to minimize the number of busses and the travel time;
- to adopt a software able to manage the work shift in order to optimize the trips (so reducing labour and fuel costs);
- to increase of shared journeys up to 20% and shared passengers up to 25%;
- to optimize time of booking of the service.

During the measure implementation several actions were implemented:

- New potential targetted on demand users were investigated among “weak users” category. “Brindo con Prudenza” project was proposed. It was a dedicated “on demand” bus service to avoid car use by young people during the weekend allowing them to drink. The project was an unsuccess.
- Benchmarking researches were carried out among different on demand software used in Italy and Powersoft sw was selected as suitable for Brescia “On demand” service,.
- Software purchasing and software testing. The software purchased was produced by Powersoft and needed to be personalized to be used for “Accabus “ according to BST specific requirements. Several problems occurred during the testing phase and Powersoft was not able to find a solution. The personalization of the software was not carried out by Powersoft and the measure was stopped.

From the evaluation point of view there was no impact of this measure on the city, as “Brindo con Prudenza” project had not have subscribers and the software purchased for “On demand” service was not considered suitable for “Accabus”.

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(EE) High level / longer term:

- To start up an “On demand transport system”, suitable for no-peak public transport demand, taking into account also the weakest users’ needs.

(FF) Strategic level:

- To investigate a new way to develop an efficient public transport service that satisfies the real needs of all citizens.

(GG) Measure level:

- (1) to manage “On demand” PT service through a suitable technology that allows flexibility and trips optimization, in order to minimize the number of busses and the travel time (increasing of shared journeys up to 20% and shared passengers up to 25% ) and reduce labour (optimizing time of booking of the service) and fuel costs;
- (2) to evaluate “On demand transport system” suitable for no-peak public transport demand, developing a service addressed to weaker users such as elderly people instead of using traditional PT service when it is not suitable.

### **A2 Description**

The measure consists in managing a service suitable for no-peak public transport demand, taking into account also the weakest users needs.

In fact, during the measure implementation Brescia Trasporti took into consideration two aspects for the improvement of the “On demand” service:

- the importance of reacing specific urban areas (especially peripheral urban areas) and
- the importance of satisfying specific PT users (such as vulnerable users).

During the measure implementation several actions were implemented:

- New potential targetted on demand users were investigated among “weak users” cathegory. “Brindo con Prudenza” project was proposed. It was a dedicated “on demand” bus service to avoid car use by young people during the weekend allowing them to drink. This service was strongly driven by the City Administration’s councillorship of “Transport, Traffic and Youth Affairs”. At the time there was a unique councillorship that in 2010 was split into the councillorship of “Mobility and Traffic” and the one of “Youth, Sport and Innovation”.

The Local Authority decided to encorage yung people to use safer late evening “On demand” public transport as an alternative to private cars. The administration involved in this project also the various urban councils, the community associations, bar/pubs, etc. Brescia Trasporti arraned dedicated meetings to implement the “Brindo con Prudenza” on-demand public transport service. The service was organised using at least 2 buses in the municipal area of Brescia, from 10.00 pm to 6.00 am Fridays and Saturdays and during holiday time period. The “On demand” bus should bring

young people from some identified collecting points in the Municipality to the bars/pubs involved in the initiatives. Only customers from 16 to 25 years old were entitled to use the service. The service had to be booked in advance by phone by 2.00 pm on Thursday. In case of a mid-week holidays, booking had to be done 2 workdays in advance.

The buses, if no calls were received, from 9 pm to 3 am were at disposal to youth along a specific itinerary. The stops were identified with the bar/pubs managers involved in the initiative. The itinerary was a close ring along "movida": starting from piazzale Arnaldo, through corso Zanardelli, via Togni, via Dalmazia, via Solferino and viale Bornata. Moreover a map of the itinerary and the stops was available in the pubs.

The service started operating on an experimental basis on 5th December 2009 to 28th February 2010. 0 calls were received by the call centre to book the service in advanced and nobody used it. Therefore the service was suspended. After this experience youth people were not considered suitable for an "On demand" night service during the weekend and the attention was completely focused on a disabled needs.

Since 1992 there has been in Brescia an "On demand" service called "Accabus". This service is suitable for off-peak public transport demand and takes into account the elderly/disabled people needs. The most important aspect of the measure is the recognition of the best technology to manage an "on call" bus service, in order to offer a renewed on-demand transport service in Brescia. The goal was an improvement of the service already offered to the public and an improvement of the planning of the same service through the acquisition of a new software able to manage the service reservations thanks to an automatic system.

Benchmarking researches were carried out among different on demand software used in Italy and Powersoft sw was selected as suitable for Brescia "On demand" service.

The system to be purchased should fit with the strategic choices made by the city of Brescia which are of a high quality and a sustainable transport system, that satisfies also the needs of the weakest users (for more details see section B4 "Actual implementation of the measure").

- Software purchasing and software testing. The software purchased was produced by Powersoft and needed to be personalized to be used for "Accabus" according to BST specific requirements. Several problems occurred during the testing phase and Powersoft was not able to find a solution. The personalization of the software was not carried out by Powersoft and the measure was stopped.

The software test failed as several technical problems occurred in relation to:

- cartography, the cartography suggested by Powersoft to BST have not got georeferenced civic numbers of the streets and several new residential areas of the city were missing
- streets name and street identification, the software was not able to recognise the same name of the street located in different neighborhoods and it was not able to identify doubled street names
- one way road with contraflow bus line, several problems occurred while introducing this figure, as the software was not able to easily allow this operation
- trip length in combined trips, when the operator ask to the software to combine trips, the software don't allow to introduce time spent on board as a prerequisite. This was one of the specific request done by BST in sw personalization.

## B. Measure implementation

### B1 Innovative aspects

- New conceptual approach
- Use of new technology/ITS
- New mode of transport exploited
- Targeting specific user groups

The innovative aspects of the measure are:

- **New conceptual approach, New mode of transport exploited, Targeting specific user groups** – An “On demand” transport system for Brescia represents a new way of facing elderly/disabled people mobility and a new way of satisfying the real needs of these specific users.
- **Use of new technology/ITS** – The existing “On demand” service can be improved purchasing a specific software able to manage all type of requests and to calculate the shortest and fastest journey. The software should plan and manage trips and must be based on map projections. It should schedule a database containing all the main features of the service, like users’ requests, the description of city’s network, the description of trips, etc. The Graphical User Interface (GUI) could be able to acquire, visualize and eventually modify data. After the elaboration of the software, it should be able to give an optimized chronological trip suitable for the users’ request (bus stops and time of beginning and end of the trip). In addition to these features, the software should have three important algorithms: one for mapping addresses on the map, one to optimize shortest trip on the cartography and the last one to optimize ways and timetable choice.

### B2 Research and Technology Development

“Accabus” is the “On demand” service that has existed in Brescia since 1992.

There has been a significant increase in the number of passengers carried (as shown in *Fig.1- data available from 1995*) and it is hoped that this figure will continue to increase. For this reason BST believed that a computerized support would be necessary for an increasingly articulated planning. At the moment the system is “manual”. The service could have been improved purchasing a specific software able to manage all types of requests and, at the same time to calculate the shortest and fastest trip.

The purchase of the software would have allowed BST to have a tool to ensure an optimum service. The result should have been the maximization of the combined trips, while reducing the use of resources ( number of busses and drivers).

YEAR	TOTAL NUMBER OF PASSENGERS
1995	6'949
1996	6'786
1997	8'436
1998	10'174
1999	10'458
2000	12'286
2001	14'030
2002	12'990

2003	14'167
2004	14'584
2005	14'977
2006	16'569
2007	17'143
2008	16'473
2009	16'649
2010	16'097
2011	16'400

*Fig.1: Total number of passengers/years*

During the RTD activities BST carried out a benchmarking about other “On demand” services already existing in other cities, in order to decide the right technical specifications to be re-proposed in Brescia and to choose the most suitable software.

There were:

- "many-to-one" software applications available mainly used for school services, for users with the same trip destination;
- software for on call services, but not for disabled services, such as the Brescia's one.

BST explained service requirements in technical specifications, pointing out the differences with the "classic" on-call services (based on the experiences of Milan and Parma, for example).

It was important to make the supplier understand the type of service required also in relation to the size of the city and to the number of users.

The software application resulting from benchmarking activity seemed to meet BST requirements.

### **B3 Situation before CIVITAS**

Since 1992 Brescia Trasporti has operated, a manual on-demand transport system (“Accabus”) reserved for disabled people, but this manual system isn’t able to optimize the resources.

This service carries customers through the city on planned or occasional dates using 6 buses, from 7.30 to 21.15. To book the service, customers have to register and buy a special type of bus-pass.

Currently, an operator, basing on his knowledge of the city’s streets (detours, one-way streets, street’s width) has to choose the best route and to calculate the time it takes. He also has to associate the service to one of the drivers available in the time slot requested.

It is necessary to book the service by phone before 2:00 pm of the day before the trip because the booking service is based on a manual system and therefore it is not possible to optimize it for what concerns:

- trip time (from the moment when the driver picks up the user to the moment when the driver leaves the user at the desired destination)
- number of trips possible at the same time.

Most of the services that Accabus provides are “one single-user service”.

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Research activities** (from October 2008 to March 2011) – During this stage an in-depth analysis of the users needs was carried out, in order to single out a solution able to satisfy users as much as possible. BST started with a benchmarking about other on demand systems already implemented in Italy, as best practice in the management of this particular kind of transport system. For example, the on demand transport system implemented in Milan

(called “RadioBus” and “Bus by night”) were studied organizing technical visits in ATM (Milan public transport company). A visit to the operative rooms and to the busses depot was arranged. Particular attention was given also to the case of the city of Parma, where an on demand service (called “PRONTO BUS” in urban area, “T-BUS” in extraurban area) is used in off-rush hours and for more flexible trips.

The implementation of two different “On demand” transport solutions was made: the first one was a night service addressed to the young; the second one was addressed to disabled users.

BST proposed an experimental phase. During this phase the national campaign “Brindo con Prudenza” (that aimed at promoting also road safety), was locally promoted by BST and CBS. This experience was an occasion to test the interest of young people to an “On demand” PT night service. The implemented service scheduled an initial subscription, to let users get a password to book the service. Users were taken to the desired destination and brought back to the starting point during the night. To book the service a call centre was available from Monday to Thursday. Call for booking was free.

The service was promoted through massive advertisement on local newspapers (“Giornale di Brescia”, “Bresciaoggi”, “il Brescia”), local reviews (“Brescia Up”), on busses (Fig. 2) and on signals spread in the city and on dedicated leaflets (Fig. 3).



Fig.2: The bus dedicated to the “Brindo con prudenza” service



Fig.3: Promotional campaign of the project “Brindo con prudenza”

*In spite of all that, from 5th december 2009 (start of the experimental phase) to 28th February 2010 (end of the experimental phase), the interest shown by young people for a night “On demand” service was null: the booking service registered 0 calls.*



Fig.4: Bus used for the existing Accabus on demand service

*Therefore, according to the measure objectives, BST decided to improve the existing daytime “On demand” service (called “Accabus”), dedicated to other specific targets (i.e. disabled or elderly people characterized by particular mobility needs during the off-peak hours) (Fig. 4). This solution required the purchase of a software for the booking service management. The Accabus service was also improved introducing 2 new busses (purchased in measure 01.06). The tender for the software purchase is included within this stage.*

*The technical specifications of the service requirements had also to integrate with the company's existing situation operating system, specific and consolidated technicians skills.*

*The software should have been able to manage all type of requests and to calculate the shortest and fastest trip.*

*After a quite long benchmarking activity, the company able to provide the most suitable software was selected (Powersoft) and on March 2011 BST received a technical and economical proposal for the whole software package, including specific customisation measures.*

**Stage 2: Operative phase** (from March 2011 to October 2012) – *In an early meeting with Powersoft, the company provided BST with the opportunity to customise the application. Personalization was a necessary condition for the implementation of the system, in order to achieve the project goal. After the software economic offer, the necessary activities for the software (application developed by Powersoft) activation started, in particular a test phase during which BST tested the SW.*

*The chosen SW had the following features:*

*The system could easily be interfaced with BST AVM system (Automatic vehicle Monitoring) and, in addition Powersoft proposed to integrate the SW with the equipment on board of the vehicles. (to make the on-board devices for the buses work correctly, data transfer needed to be bi-directional between the Operations Centre and the vehicles, using various types of vectors which could be integrated).*

*The PowerDriver DTSS system could solve and optimize trip planning offering a flexible transport service (with no need to plan routes, starting points, termini or stops in advance).*

*DTSS could organize the vehicle routes by entering any new request during the current ride. As a result, transit could be faster and the use of the vehicles could be maximised.*

#### **Testing phase of the SW provided by Powersoft:**

*In this phase both the old and the new software were used to simulate the management of the service.*

*BST installed the new SW provided by Powersoft and started a testing phase in Brescia.*

*DTSS uses a GIS System (Geographic Information System), duly interfaced with the database, to configure the service network. The database must also contain the remaining viability elements such as speed, bus transit times and direction (inbound/outbound) for the different time bands, days and periods. The database can be updated with data gathered while the service is actually being provided.*

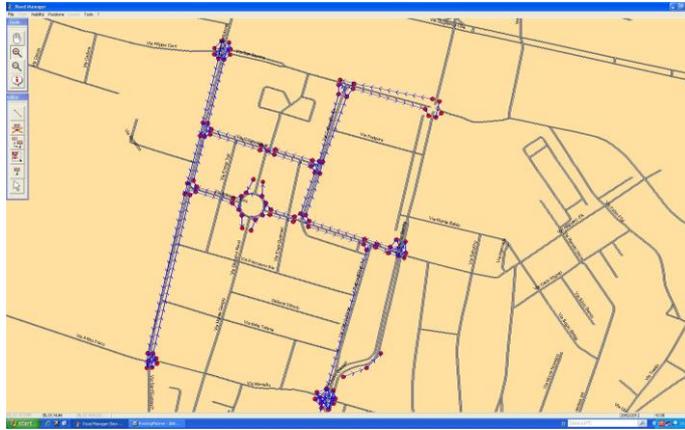
*During this testing phase several managing problems arose in the data input phase required by the two SW modules "Road Manager" and "Routing planner" to work correctly*

#### **- "Road manager"**

*This module is primarily concerned with the management of the map. You must enter all the information on the roads that the buses of the Accabus service can take. After the acquisition of maps, which contain references to civic numbers, you must define the directions of roads and intersections (Fig.5).*

*Data entry in Road Manager is a necessary condition to start the simulation, therefore it must be constantly updated in order to produce a good result: so the first step of planning is to enter any deviation related to the actual conditions of the area (work in progress, modification of the one-way, etc.).*

*This condition needs to have a dedicated person to constantly update the data for all the city and suburbs served by PT transport.*



**Fig.5: Road Manager Interface**

### **- Routing Planner Module**

*Routing Planner automatically creates the best routes according to the geographic position of the addresses and destinations to be reached, taking into account any extra criteria defined by the operator, such as:*

- optimum passenger load (or best vehicle occupancy);
- shortest transit time;
- maximum time on board the vehicle (this is a fundamental criterion in BST case, since their passengers are disabled);
- minimum number of vehicles in use.

*The DTSS system can generate a series of final data pertaining to each single day or to a period of time defined by the operator. The main data are:*

- kilometres covered by each vehicle;
- number of passengers carried;
- ride time / idle time per vehicle;
- number of bookings;
- number of people on board a bus at any given time;
- average length and duration of each ride per vehicle;
- number of passengers carried by a bus.

*To plan the service, the planning module requires the operator to enter basic data (vehicle and final destination) as well as the users' requests (destination and times), using georeferenced maps. The needed cartography<sup>19</sup> was not updated, and once acquired it was necessary to purchase a new PC to manage both cartography and SW.*

<sup>19</sup> 16th march 2011 - focus on the type of cartography supported by the software;

31st March 2011 - the software does not support the existing maps so, upon Powersoft recommendation, BST contacts Ubiest (Company for the map) for an offer on the supportable cartography needed to implement the system;

8th April 2011 - Ubiest provided BST with an economic offer for the right cartography (the second one, that BST had to pay for to speed up the process, despite the fact that assessment of the map's compatibility was up to Powersoft)

The routing planner module test phase foreseen in February 2012 was postponed.

While waiting for the updated maps BST was able:

- to roughly plan the service on the basis of the existing system,
- to analyse the potential of the PowerDriverDTSS various masks and,
- to see which elements could really better the system already used

A database of regular users (Fig.6, 7) was loaded into the system, but only when the maps were available it was possible to add the data concerning the starting point of each journey and the relevant destination.



Fig. 6: Database of regular users

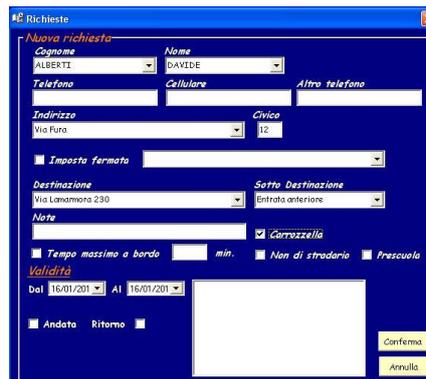


Fig. 7: User database: the address, destination and sub-destination fields have been filled but their graphic representation on the maps is missing, since the maps is pending.

After receiving a complete set of maps from Powersoft, BST checked if a wider and better choice of services could really be provided to passengers.



Fig.8: Example of booking management using the new software

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11th April 2011 - request of purchase for Powersoft software, Ubiest maps  
 27th April 2011 - Acquisition of Ubiest Cartography

*The main problems were:*

- *that the SW could not work correctly in relation to street managing in fact PT service serve Brescia and suburbs in which there are streets with the same name. The SW has also problems in managing streets with long names (it automatically cuts of the excessive characters);*
- *that the SW is not able to manage a real "door to door" service. Infact civic number are not managed as they are in reality.*
- *Powersoft was not able to find a solution to these basic problems.*

*Therefore the testing phase of the SW wasn't considered succesful and it was decided not to use the SW for on demand service "Accabus".*

## **B5 Inter-relationships with other measures**

As one of the objectives of the measure is to improve the public transport service quality, this measure has interactions with **Measure no. 01.06 "Clean and energy efficient public transport fleet in Brescia"** in which buses for On demand service were bought.

## C. Evaluation – methodology and results

From the evaluation point of view the main objective of the measure consisted in the evaluation of an “On demand transport system” suitable for no-peak public transport demand, and in developing the technology to manage this kind of service in Brescia.

The evaluation at the beginning of the project foresaw the measuring of the impact of the SW use, especially in optimizing the trips, ways and timetable choices.

The testing phase of the SW wasn’t considered succesful and it was decided not to use the SW to manage the on demand service “Accabus” reservations.

The not successful testing phase didn’t allow to evaluate the measure impact. Therefore the ex post data collection wasn’t carried out and the comparison After-Before; After-BaU is missing. As a consequence the evaluation was focussed mainly on the measure process.

### C1 Measurement methodology

The indicators were set to evaluate the measure efficiency in terms of objectives achievement. (see section C1.1).

The selected indicators, n. 7 (Km per day maximum) and 8 (Software flexibility) should have been particularly useful for the up scaling.

Indicator 5 (N. of calls per year) was deleted from the initial list of indicators. The new software purchased didn’t register the numeber of calls therefore such indicator was useless to measure the software performance. The purchased software was only able to improve the trip organization, while the call center for the trip reservations was expected to work like before, without monitoring the actual number of calls received, but only estimating them.

#### C1.1 Impacts and Indicators

Only ex-ante was collected.

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Economy	Average operating revenues	Periodic reporting of operating revenues – BST database	The economical indicators are provided directly by the MLs as the detailed values are considered “sensitive” data, therefore they cannot be spread. Main Indicator
2	Economy	Average operating costs	Investment costs of service implementation - BST database	The economical indicators are provided directly by the MLs as the detailed values are considered “sensitive” data, therefore they cannot be spread. Main Indicator
3	Transport	Quality of service	Survey among on demand users - BST database	Main Indicator
4	Transport	Waiting time	Minimum waiting time	Main Indicator

			from the reservation of the trip to the use of the vehicles	
5	Transport	calls per year	Number of calls recorded	NO MORE COLLECTED
6	Transport	total number of passengers per year	total number of passengers per year - BST database	Main Indicator
7	Transport	Km per day maximum	Total number of kms per year - BST database	Useful for the up scaling Main Indicator
8	Transport	Software flexibility	Number of combined trips respect to the total number of trips	Useful for the up scaling Main Indicator
9	Society	Awareness level	Variation of the total passengers respect to the previous year	Main Indicator
10	Society	Acceptance level	Number of passengers that changed their habits: from occasional to systematic users	Main Indicator

Detailed description of the indicator methodologies:

- **Indicator 1 (AVERAGE OPERATING REVENUES)** – Is defined as the ratio of total income generated from fares and tickets divided by the total passenger-km in a given time period (year). Because of sensitive data, this indicator is provided directly by the ML.
- **Indicator 2 (AVERAGE OPERATING COST)** – is defined as the ratio of total operating costs incurred by a service divided by the total passenger-km or vehicle-km completed by the service in a given time period (for example day, week, month or year). Operating costs include, for example, the personnel costs, fuel, electricity and maintenance costs for the vehicle(s) involved. They do not include **investment costs** in vehicles and infrastructure, etc. Because of sensitive data, this indicator is provided directly by the ML.
- **Indicator 3 (QUALITY OF SERVICE)** - In order to monitor the quality of service, a survey among the “On demand” users has been arranged. The administered questions are listed below and for each question interviewed people answered giving a mark from 0 (worst judgement) to 10 (best judgement). See Annex 3.

Questions:

1. Service booking conditions;
  2. Vehicles cleanliness;
  3. Satisfaction about the comfort on board;
  4. Satisfaction about the driver’s kindness/helpfulness;
  5. Satisfaction about the punctuality.
- **Indicator 4 (ACCURACY OF TIME KEEPING IN ON DEMAND SERVICE)** - Minimum waiting time is defined as the time between the call to phone centre and the arrival of the bus at the bus stop.
  - **Indicator 5 (N OF THE CALLS BEHIND PER HOUR)** – the indicator has been deleted from the initial list. **NO MORE COLLECTED**

- **Indicator 6** (*N OF POTENTIAL PASSENGERS/IN A GIVEN TIME PERIOD*) - Total number of passengers per year.
- **Indicator 7** (*KMS PER DAY MAXIMUM*) - Total number of kms per year traveled by the vehicles used for the “On demand” service.
- **Indicator 8** (*SOFTWARE FLEXIBILITY*) - This indicator is expressed by the total number of combined trips (more than one passenger per trip) respect to the total number of trips.
- **Indicator 9** (*AWARENESS LEVEL*) - Variation of the total number of passengers respect to the previous year.
- **Indicator 10** (*ACCEPTANCE LEVEL*) - is intended as the number of passengers that changed their habits: from occasional to systematic “On demand” service users. The indicator is calculated as variation of the number of systematic users respect to the previous year.

## C1.2 Establishing a Baseline

The “On demand” service in Brescia called “Accabus”, dedicated to disable people, has existed in Brescia since 1992 and it is managed by Brescia Trasporti SpA. Before the implementation of the Civitas measure, for the service erogation, a Software was already available, but it still was “manual” (for example, in the organization of the itineraries based on the reservations received by the call center).

As the new software for the service management was purchased in 2011, the baseline year was set in 2010 for all the indicators.

Indicator 1 and 2 (Average operating costs and revenues) evaluate economical aspects linked to the on demand service erogation and were provided directly by the transport company.

• Indicators concerning economical aspects	• BASELINE (2010)
• 1. Average operating revenues	• 2,29
• 2. Average operating costs	• 16,56

Tab. 1: Indicators concerning economical aspects

Indicators 3, 9 and 10 (quality of service, awareness and acceptance level) give an idea of the overall perception of the service by the on demand service users. In particular, the quality of service (ind. 3) was collected through the administration of a questionnaire to the users asking them their opinion about the service. The awareness and acceptance level derived from the historical data series of the on demand passengers, as the service is dedicated to disable people and is object of conventions with the Municipality of Brescia. The awareness level was expressed by the variation of passengers respect to the previous year, as a positive variation of this indicator could mean a higher level of awareness of the service. The acceptance level was expressed by the variation of the number of systematic users respect to the previous year, as a positive variation of this indicator could mean a higher level of acceptance towards the service.

• Indicators concerning the overall service perception by the users	• BASELINE (2010)
3. Quality of service	• average judgement: 8,6/10
• 9. Awareness level	• Variations of the number of passengers respect to the previous

	year -3,3%
• 10. Acceptance level	• Variations of the systematic users respect to the previous year = -7,6%

Tab. 2: **Indicators concerning the overall service perception by the users**

Indicators n. 4 (Waiting time), 6 (total number of passengers per year), 7 (Kms per day maximum) and 8 (Software flexibility) have been selected to monitor the overall features of the service, as they will probably benefit from the introduction of the new software in terms of total number of passengers yearly transported, Kms traveled by the on demand vehicles per year and number of combined trips.

• Indicators concerning overall features of the service	• BASELINE (2010)
• 4. Waiting time	• 17 hours and 30 minutes
6. total number of passengers per year	• 16'097
7. Kms per day maximum	• 121'099
• 8. Software flexibility	Percentage of combined trip respect to the total trips =15,8%

Tab. 3: **Indicators concerning overall features of the service**

Indicator 5 (number of calls per year), as better explained in the C.1 and C.1.1. sections of this MERT, hasn't been collected because in the light of the new purchased software, the number of calls won't be registered but estimated like before and wouldn't benefit from the new software introduction.

### C1.3 Building the Business-as-Usual scenario

The BaU scenario building generally take as reference the assumption that without the Civitas contribution probably the new software for the on demand service management wouldn't have been purchased.

As regards the indicators n. 1 (Average operating revenues) and 2 (Average operating costs), concerning the economical aspects linked to the on demand service, 3 historical data were available, referring to years 2008, 2009 and 2010. These data cannot be considered a sufficient series to project a reliable trend curve, therefore the following assumptions have been done. The 3 available values show an alternate trend, that demonstrate that the value of these indicators depend on external factors such as for example the active conventions with the Municipality of Brescia, the kind of users to which the service is addressed that have specific mobility needs or the influences caused by extraordinary events (breaks of the vehicles, and so on). Therefore, as cautelative value, the average number of the 3 was taken as reference for the BaU scenario.

Indicators concerning economical aspects	BaU (2012)
1. Average operating revenues	2,18
2. Average operating costs	16,08

Tab. 4: BAU for **Indicators concerning economical aspects**

As regard indicator 3 (quality of service), 3 historical data were available, referring to the questionnaires administered in 2008, 2009 and 2010. These data cannot be considered a sufficient series to project a reliable trend curve, therefore the following assumptions were made: looking at the

3 available values, year 2009 registers a value that is higher than year 2008 and 2010, but the number of the filled in questionnaires was lower. For these reasons the value registered in 2009 was considered anomalous, therefore the BaU scenario for this indicator equals the average values registered for the other 2 years.

<b>Indicators concerning the overall service perception by the users</b>	<b>BaU (2012)</b>
3. Quality of service	average judgement: 8,6/10

Tab. 5: BAU for **Indicators concerning the overall service perception by the users**

Indicators 9 (Awareness level) is calculated basing on the number of on demand passengers while indicator 10 (Acceptance level) is calculated basing on the number of on demand systematic passengers. The methodological assumption made for the BaU scenario building of these indicators is the following: the historical data series available for the indicators 9 and 10 are characterized by an alternate trend that doesn't take into consideration the external factors that could influence the success of the on demand service. As a matter of fact, the service is centered on a particular kind of users (disable people) which have very specific mobility needs.

As regards indicator 9, the total number of passengers (directly deriving from the indicator n. 6) was projected in order to calculate the BaU value of the indicator n. 9 using the estimated theoretical data as reported in the following table (Tab. 6).

YEAR	Ind. 6 Total number of on demand passengers (in RED the estimated theoretical values)	Ind. 9 Variations respect to the previous year of the number of on demand passengers (in red the calculated values basing on the estimated theoretical number of passengers)
1995	6'949	-
1996	6'786	-2,30%
1997	8'436	24,30%
1998	10'174	20,60%
1999	10'458	2,80%
2000	12'286	17,50%
2001	14'030	14,20%
2002	12'990	-7,40%
2003	14'167	9,10%
2004	14'584	2,90%
2005	14'977	2,70%
2006	16'569	10,60%
2007	17'143	3,50%
2008	16'473	-3,90%
2009	16'649	1,10%
2010	16'097	-3,30%

2011	18986	18%
2012	19683	4%

Tab. 6: number of on demand passengers and Variations respect to the previous year

Similarly to the previous indicator, as regards indicator 10, the total number of systematic passengers (data provided for the calculation of indicator 10) was projected in order to calculate the BaU value of the indicator n. 10 using the estimated theoretical data as reported in the following table (Tab. 7).

YEAR	TOTAL NUMBER OF SYSTEMATIC PASSENGERS (in RED the estimated theoretical values)	Ind. 10 Variations of the systematic users respect to the previous year (in red the calculated values basing on the estimated theoretical number of systematic passengers)
1995	4'565	-
1996	4'377	-4,10%
1997	5'374	22,80%
1998	6'373	18,60%
1999	7'463	17,10%
2000	8'543	14,50%
2001	8'963	4,90%
2002	8'325	-7,10%
2003	8'754	5,20%
2004	9'335	6,60%
2005	10'201	9,30%
2006	12'008	17,70%
2007	11'264	-6,20%
2008	9'318	-17,30%
2009	9'538	2,40%
2010	8'815	-7,60%
2011	11572	31%
2012	11952	3%

Tab. 7: number of systematic passengers and Variations respect to the previous year

Indicators concerning the overall service perception by the users	BaU (2012)
9. Awareness level	Variations of the number of passengers respect to the previous year = +4%
10. Acceptance level	Variations of the systematic users respect to the previous year = +3%

Tab. 8: Indicators concerning the overall service perception by the users

The indicator n. 4 (waiting time) expresses the maximum waiting time that people have to wait from the reservation of the trip and the beginning of the service the day after. Without the Civitas contribution the Software, that should have improved the on demand bus service, including the waiting time, wouldn't have been purchased, therefore the BaU scenario value for this indicator equals the baseline one.

Indicator 5 (number of calls per year), as better explained in the C.1 and C.1.1. sections of this MERT, were removed from the initial list of indicators because in the light of the new purchased software, the number of calls could not be registered but only estimated like before.

Indicator 6 (total number of transported passengers per year) can count on the availability of historical data series, therefore the BaU scenario was calculated projecting the historical data.

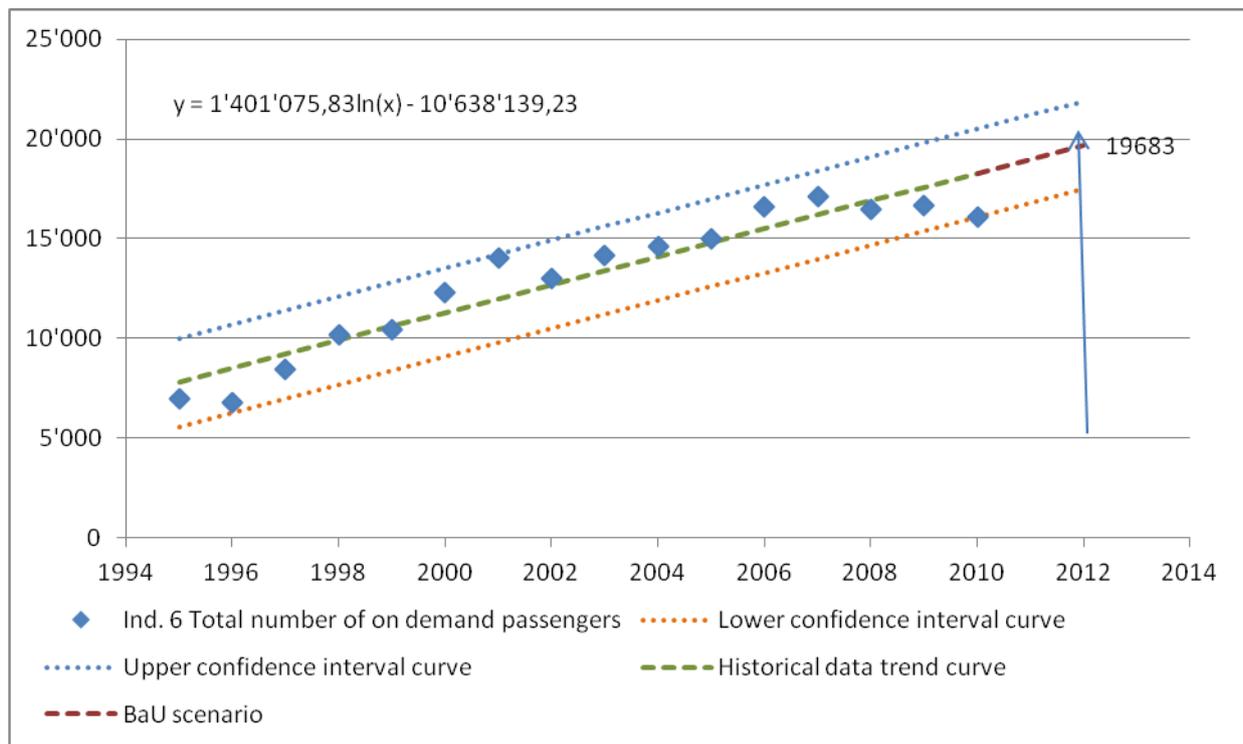


Fig. 9: projection of the historical data referred to the number of on demand passengers

As regard indicator 7 (Kms per day maximum), 4 historical data are available, referred to years from 2007 to 2010. As the historical data series is not sufficient for the projection of a reliable trend curve, for the BaU building of this indicator the following consideration were made: the traveled kms by the on demand busses per year seem to be correlated to the total number of passengers per year, as the amount of combined trips (with more than 1 passenger) is of modest entity respect to the total trips. Looking at the values of indicator 6 (total number of passengers per year) referred to the period 2007-2010 this hypothesis seems to be confirmed. As a matter of fact there's an overall slight decrease of the number of passengers in the last 4 years. The BaU value for this indicator corresponds to the average value of the 4 years period available. Taking as BaU value the Baseline one wouldn't be coherent with the general increase of the total number of passengers that derives from the projection of a longer historical data series (since 1995).

As regard indicator 8 (Software flexibility) expressed by the Percentage of combined trip respect to the total trips, 3 historical data are available, referred to years from 2008 to 2010.

Indicators concerning overall features of the service	BaU (2012)
4. Waiting time	17 hours and 30 minutes
6. total number of passengers per year	19683
7. Kms per day maximum	127890
8. Software flexibility	Percentage of combined trip respect to the total trips =15,97%

Tab. 9: Indicators concerning overall features of the service

## C2 Measure results

The Before and BaU values are presented under sub headings corresponding to the areas used for indicators – economy, society and transport.

As already mentioned the evaluation foresaw the measuring of the impact of the SW in optimizing the trips, ways and timetable choices.

The not successful testing phase did not allow evaluate the measure from and impact point of view. Therefore the following tables are filled only in relation to baseline (Before) and BaU. The After value are **Not Assessed**.

### C2.1 Economy

Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”

Indicator	Before (2011)	B-a-U (2012)	After (date)	Difference: After – Before	Difference: After – B-a-U
1. Average operating revenues (€/pkm)	Year 2011 = 2,42	Year 2012 = 2,18	<b>Not Assessed (the measure was stopped)</b>	/	/
2. Average operating costs (€/pkm)	Year 2011 = 16,55	Year 2012 = 16,56	<b>Not Assessed (the measure was stopped)</b>	/	/

### C2.4 Transport

Table C2.4.1: Measure results for the indicators of the category “Transport”

Indicator	Before (2011)	B-a-U (2012)	After (date)	Difference: After – Before	Difference: After – B-a-U
3. Quality of service	N° of questionnaires: 25 Average mark per year and per question and total average mark per year: 8,96/10	Average judgement: 8,6/10	<b>Not Assessed (the measure was stopped)</b>	/	/

4. Waiting time	The on demand service consists in reserving the trip within 2:00 p.m. of the previous day. As the first trip starts at 7:30 a.m., the minimum waiting time is 16 hours and 24 minutes	17 hours and 30 minutes	<b>Not Assessed (the measure was stopped)</b>	/	/
5. N. of calls per year	NO MORE COLLECTED		<b>Not Assessed (the measure was stopped)</b>	/	/
6. total number of passengers per year	Ind. 6: 16.400	Ind. 6: 19.683	<b>Not Assessed (the measure was stopped)</b>	/	/
7. Kms per day maximum	Total Kms in year 2010: 128'274	Total Kms in year 2012: 127.890	<b>Not Assessed (the measure was stopped)</b>	/	/
8. Software flexibility	Percentage of combined trip respect to the total trips: 12,57%	Percentage of combined trip respect to the total trips =15,97%	<b>Not Assessed (the measure was stopped)</b>	/	/

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category "Society"**

Indicator	Before (2010)	B-a-U (2012)	After (date)	Difference: After –Before	Difference: After – B-a-U
9. Awareness level	Variation respect to the previous year: +1,88%	Variations of the number of passengers respect to the previous year: +4%	<b>Not Assessed (the measure was stopped)</b>	/	/
10. Acceptance level	Total number of systematic passengers (2011): 8.919 Total number of occasional	Variations of the systematic users respect	<b>Not Assessed (the</b>	/	/

	passengers (2011): 7.481 Total number of passengers (2011): 16.400 Variation of systematic users respect to the previous year: +1,18	to the previous year: +3%	<b>measure was stopped)</b>		
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### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Management of “On demand” PT service through a suitable technology that allows flexibility and trips optimization, in order to minimize the number of busses and the travel time and reduce labour and fuel costs; <i>Only the testing phase has been implemented, therefore the objective achievement hasn't been assessed during CIVITAS project.</i>	<b>NA (the measure was stopped)</b>
2	Evaluation of an “On demand transport system” suitable for no-peak public transport demand, developing a service addressed to weak users such as elderly people instead of using traditional PT service when it is not suitable; <i>Only the testing phase has been implemented, therefore the objective achievement hasn't been assessed during CIVITAS project.</i>	<b>NA (the measure was stopped)</b>
<b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b> <b>** = Achieved in full    *** = Exceeded</b>		

### C4 Up-scaling of results

No data are available to do the upscaling.

From a teoretical point of view it must be underlined that “On demand” service (Accabus) is already extended to all the city.

### C5 Appraisal of evaluation approach

In this section we explain the problems incurred during the test implementation linked with the SW utilization. The evaluation of the measure is in fact referred not to the target achievement, but to the process evaluation.

CIVITAS project was important because it offered the chance to analyse the software available and the experiences of other already working services, assessing the possibility of personalizing the available software. This analisys is interesting to allow the measure replication and transferibility. This section is organized in a schematic way in order to sintetize the main aspects.

#### MAIN OBJECTIVE FOR THE COMPANY – ACTUAL SERVICE ORGANIZATION:

Brescia Trasporti needed to purchase a software which could deal with “on Call Service” that at present is manually dealt with.

Now the user calls the operator on duty, the latter, after taking note of the call, has to organize the trip by 5 pm of the day prior to the request, and he has to contact the user confirming the trip.

This kind of organization is clearly limited by both manual dealing and the impossibility of organizing requests. On the other hand, in a town like Brescia it can satisfy the users' requests transforming the service into an "ad hoc" service which takes into consideration the user's needs - it is to be underlined that in our case the user is disabled. Actually the "Accabus" user is a dependent customer and, in time, the relationship has gone well beyond the customer-supplier relationship.

### **BENCHMARKING ACTIVITIES**

In Milan BST technicians visited the centre which deals with on demand transport service, and the presence of dedicated personnel who dealt with the booking service, besides the software, was instantly noticed.

Commercially the BST choice was to buy Powersoft DTSS, which was seen in Milan, as it would easily interface with the equipment already on board the busses.

As this kind of software was originally designed for school transport some personalisations were required for the "Accabus" service.

### **TEST PHASE: MAIN ACTIVITIES AND RELATIVE PROBLEMS**

During the experimental phase there were several problems to be faced as, for instance, specific reference mapping.

#### ✓ CARTOGRAFY AND ITS USE

In the traditional cartography there is no layer of precise civic numbers, besides this, in "normal" cartography there is no correspondence between the lanes for general vehicles and those dedicated to TPL. Time was spent for the purchase of new cartography; also this last one isn't complete in all its areas (for instance the whole area of council house buildings of Sampolino is missing) and civic numbers are marked spreading numbers between the first and the last civic ones, without the exact location. It would be necessary to go all around the city and manually correct existing cartography, overlapping it with the BST one, marking at every crossroad and along each arch which route the bus can actually follow, setting the standard speed per each arch. This would still give only approximate running time as it would not be possible to foresee traffic flow. It could be possible to impose a suitable running speed thought the software doesn't consider boarding time.

This seems to be one of the first critical points, keeping in mind that the software was originally designed for a "door to door" booking service, that is to say: from each user's civic number to each user's different destination, satisfying specific needs.

#### ✓ THE MAIN SOFTWARE DEFECTS

After tests, made by qualified technical personnel, it was clear that the software presents those defects typical of a software which has been tested little (it has neither got a consulting manual!).

In using this software for its service some "worms" that make the entering of information very slow, were evident. It is critical to enter the name of streets, as it foresees an archiving system based on time and not one based on alphabetical order besides the SW objectis to streets with a slightly different name as Via dei Musei and Via Musei. There also is the problem with homonymy of streets which are in boroughs close to one another, that are served by the on Call Service. The programme works researching streets not boroughs. Only a certain number of characters is allowed, the extra ones are cut off. The Christian name has to be entered before the family name so, quite often, most of the characters available have already been used just to write the first part of the name of the street.

It is particularly difficult to set parameters aiming at optimising the service, also because a lot of them are subjective. Such defect is typical of an immature software which still needs an important calibrating phase.

### **THE SOFTWARE USE: SOME QUALITATIVE/ECONOMICAL CONSIDERATIONS**

When considering the quality that BST offers its users it is clear that the service quality is overall important as the passenger and his needs are the main concern. It is obvious that a software can't consider such needs. The software service would be an anonymous service and it would surely

influence the user's opinion and reflect on the number of the same users. The users number with the existent service has nearly tripled from 1995 (6,949 passengers) to 2011 (16,400 passengers).

All in all, it is evident that the good intentions which prompted the purchase of a software for the bettering of the "on demand" transport system clashed, in Brescia, with the costs required to implement and run the booking centre in the right way, leading to the disadvantage of the quality of the service which is now focused on the user's needs, on the user himself, that a machine cannot consider.

From an economical point of view, the actual service is implemented with the support of 2 drivers for 2 hours a day (BST calculate a personnel cost/year of €. 15.000,00 for the managing of the actual service).

The use of the new software would require 2 drivers for 2 hours a day, to receive the call but also the expertise of a TECHNICIAN to enter info data in the software as otherwise it would be impossible create the service (Structuring and running of the software). The cost for this activity would be about €. 45.000,00/year.

It is therefore very important to assess and verify all aspects of the proposed solution.

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – Thanks to CIVITAS Project has been organized the benchmarking activities and a SW has been purchased to manage On demand service, but owing to the encountered problems it will be used for school service. It will be tested for the school service in Desenzano del Garda, BS, where the service has to be set up.

## **C7 Future activities relating to the measure**

BST has decided to systematically use software, in the future, for school service as it is characterized by gathering stops and a single destination. In particular, in this case it goes from multiple origins to a single destination.

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## D. Process Evaluation Findings

### D.0 Focused measure

This measure is not a focused one.

### D1 Deviations from the original plan

The deviations from the original plan comprised:

**Deviation 1 title** –SW testing phase was longer than expected and several problems incurred were related to the cartography set up.

### D2 Barriers and drivers

In the following we summarise under key headings some of the barriers and drivers experienced during the implementation of the measure.

#### D2.1 Barriers

##### testing phase

**A general lack of customisation of the program is the main causes of the unsuccessful of the measure, in fact:**

- **Barrier 1** – At the beginning BST had problems with the cartography (origins and users' destinations should be georeferenced): a new map was purchased, as Powersoft company did not verify the compatibility of the map with the software).
- **Barrier 2** – the SW could not work correctly in relation to street managing in fact PT service serve Brescia and suburbs in which there are streets with the same name. The SW has also problems in managing streets with long names (it automatically cuts of the excessive characters);
- **Barrier 3** - the SW is not able to manage a real" door to door" service. Infact civic number are not managed as they are in reality.

##### Organizational phase

- **Barrier 1** –costs to manage the SW and to organize the service hasn't been appropriately considered
- **Barrier 2** – Before the start up of the metroline by 2013, Brescia Trasporti don't want to change the personelle already dedicated to Accabus.

#### D2.2 Drivers

None!

## D2.3 Activities

- **Recovery action 1)** cartografy - the software required a complex preliminary phase to build up the input database, which also required Brescia Trasporti to purchase two different new cartographies. As a matter of fact, Power Soft suggested to purchase the first cartography, which actually wasn't suitable to On Demand transport needs: this cartography didn't have the street numbers, while an On demand transport for disabled people requires a "door to door" service. The second cartography, purchased by Brescia Trasporti, after the UBIEST updates and after the Power Soft suggestion, still wasn't detailed enough: in fact, the streets numbers were incomplete, or they were missing on one side of the streets, or they were only partially inserted. Many personalization were introduced.
- **Recovery action 2)** specific courses. In July PowerSoft performed the basic training course and BST started the training of the actors by the acquisition of the software operating manual. Only in retrospect BST realized that this phase was initially underestimated.

## D3 Participation

### D.3.1 Measure partners

The partners related to this measure is Brescia Municipality.

### D.3.2 Stakeholders

Mention of the stakeholders does not imply a certain degree of activity, influence or interest but is simply a list, for each activities implemented in the measure

- **Stakeholder 1** – Citizens also with disabilities, students, Public Transport Users, Powersoft company.

## D4 Recommendations

- **Recommendation 1** - before deciding to substitute an efficient and high quality level service (such as Accabus) it is important to understand if a new SW is really able to improve benefits.
- **Recommendation 2** – contractual aspects related to service requirements and technical specifications for an "On demand" SW must not be undervalued
- **Recommendation 3** – From an economical point of view is very important to assess and verify all aspects of the proposed solution (also personnel required and respective costs!!!!).
- **Recommendation 4** – to manage a "real On demand service" is necessary to upgrade info on cartography in real time (daily upgrated info on street site, the close roads, ...). This activity must be opportunally estimated!

## Annex 1: Data used for the BaU building

- **Indicator 1** (*Average operating revenues*) – Unit: €/pkm

Year 2008 = 2,29

Year 2009 = 1,96

Year 2010 = 2,29

- **Indicator 2** (*Average operating costs*) – Unit: €/pkm

Year 2008 = 16,05

Year 2009 = 15,64

Year 2010 = 16,56

- **Indicator 3** (*Quality of service*) -

Year	2008	2009	2010
N° of questionnaires	29	11	27

Average mark per year and per question and total average mark per year:

Questions n.	Average mark		
	2008	2009	2010
1	8,6	10,0	8,9
2	7,3	8,4	7,8
3	8,2	8,4	7,8
4	9,6	10,0	9,4
5	9,5	9,9	9,3
<b>Total average mark</b>	<b>8,6</b>	<b>9,3</b>	<b>8,6</b>

- **Indicator 6** (*N of potential passengers/in a given time period*):

YEAR	TOTAL NUMBER OF PASSENGERS
1995	6'949
1996	6'786
1997	8'436
1998	10'174
1999	10'458
2000	12'286
2001	14'030
2002	12'990
2003	14'167
2004	14'584
2005	14'977
2006	16'569
2007	17'143
2008	16'473
2009	16'649

Measure title:

## On demand public transport services in Brescia

City: **Brescia**

Project: **Modern**

Measure number: **06.02**

2010	16'097
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- **Indicator 7** (Kms traveled by the on demand vehicles per year):

Year	2007	2008	2009	2010
<b>Total kms</b>	143'028	121'685	125'747	121'099

- **Indicator 8** (*Software flexibility*):

	Total single trips	Total combined trips	Total trips	Percentage of combined trip respect to the total trips
2008	12'290	1984	14274	16,1%
2009	12'379	1985	14364	16,0%
2010	12'025	1894	13919	15,8%

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1** (*Average operating revenues*) – **Unit:** €/pkm

$$A = B / C$$

where: A = Average operational revenue for the service (€/pkm)

B = Total operational revenue for the service (€)

C = Total passenger-kilometres (pkm) for the service

EX ANTE SITUATION:

Year 2011 = 2,42

- **Indicator 2** (*Average operating costs*) – **Unit:** €/pkm

Operating costs include, for example, the personnel costs, fuel, electricity and maintenance costs for the vehicle(s) involved. They do not include **investment costs** in vehicles and infrastructure, etc.

$$A = B / C$$

where: A = Average operational cost for the service (€/pkm)

B = Total operational cost for the service (€)

C = Total passenger-kilometres (pkm) for the service

EX ANTE SITUATION:

Year 2011 = 16,55

- **Indicator 3** (*Quality of service*) -

EX ANTE SITUATION refers to the years 2011, as the operative phase is related to the new software purchase (scheduled in 2012). See section Annex 3

Year	2011
N° of questionnaires	25

Average mark and per question and total average mark:

Questions n.	average mark (2011)
1	8,76
2	8,32
3	9,08
4	9,28
5	9,32
<b>Total average mark</b>	<b>8,96</b>

- **Indicator 4** (*Accuracy of time keeping in on demand service*) - **Minimum waiting time**

EX ANTE SITUATION: referred to year 2011 (before the implementation of the new software). Actually the on demand service consists in reserving the trip within 2:00 p.m. of the previous day. As the first trip starts at 7:30 a.m., the minimum waiting time is 16 hours and 24 minutes.

- **Indicator 5** (*N of calls per year*)

NO MORE COLLECTED

- **Indicator 6** (*N of potential passengers/in a given time period*):

EX ANTE SITUATION

YEAR	TOTAL NUMBER OF PASSENGERS
2011	16'400

- **Indicator 7** (*Kms traveled by the on demand vehicles per year*):

EX ANTE SITUATION

Year	2011
Total kms	128'274

- **Indicator 8** (*Software flexibility*):

EX ANTE SITUATION

	Total single trips	Total combined trips	Total trips	Percentage of combined trip respect to the total trips
2011	12'435	1788	14223	12,57%

- **Indicator 9** (*Awareness level*):

EX ANTE SITUATION

YEAR	TOTAL NUMBER OF PASSENGERS	Variations respect to the previous year
2011	16'400	+1,88%

- **Indicator 10** (*Acceptance level*):

EX ANTE SITUATION

YEAR	TOTAL NUMBER OF SYSTEMATIC PASSENGERS	TOTAL NUMBER OF OCCASIONAL PASSENGERS	TOTAL NUMBER OF PASSENGERS	Variations of the systematic users respect to the previous year
2011	8'919	7'481	16'400	+1,18%

### **Annex 3: Survey among the “On demand” subscribers**

Considering the subscribers (80 users), the questionnaire are administered once a year (20/25 users are involved), and the sample size is chosen so that, in turn, all the users express their opinions every 3/4 years. The range of users is composed by 16 to 65 years people; the group is heterogeneous, the service is in fact done for many different reasons: work / study (mainly university), free time, time spending at the supermarket, ..)

Modulo Questionario Utenti ACCABUS\_0



**THE TRANSPORT QUALITY FOR USERS**

In order to monitor and improve the quality of service, please, compile this questionnaire, giving a mark from 0 (worst judgement) to 10 (best judgement).

- Service booking conditions (willingness to satisfy the customer's request)

1	2	3	4	5	6	7	8	9	10
not very satisfied			enough satisfied				very satisfied		

Note.....

- Vehicles cleanliness

1	2	3	4	5	6	7	8	9	10
not very satisfied			enough satisfied				very satisfied		

Note.....

- Satisfaction about the comfort on board;

1	2	3	4	5	6	7	8	9	10
not very satisfied			enough satisfied				very satisfied		

Note.....

- Satisfaction about the driver's kindness/helpfulness;

1	2	3	4	5	6	7	8	9	10
not very satisfied			enough satisfied				very satisfied		

Note.....

- Satisfaction about the punctuality.

1	2	3	4	5	6	7	8	9	10
not very satisfied			enough satisfied				very satisfied		

Note.....

OBSERVATIONS:

.....

## **M06.05 – Executive summary**

Car Sharing service introduced a new mean of transport in Brescia, integrated with other ones, that represents an intelligent way of driving everywhere without financial disadvantages. The car sharing service represented an important innovation as regards the modal split in Brescia, also towards an integrated view of transport systems of the city, linked with both the new metro line realization and the "smart city" image of Brescia. The Brescia Car Sharing service has been also integrated with the existing Italian network of car sharing (namely ICS, "Initiative Car Sharing").

Considering the medium size of the city and the geographic distribution of its citizens, a study of the needs to be met by car sharing was carried out, as well as a benchmarking to evaluate other car sharing experiences in Italy, to find out the best way to manage the new service. A scheme suitable for Brescia was defined and the tender documents for the award of service was prepared.

The main problem to be solved was related to Car Sharing fleet dimension in relation to size of the city.

Muovosviluppo (i.e. the company who won the tender) decided to focus its offer more on the variety of deals (for e.g. hotel – car sharing) and agreements (for e.g. with the University of Brescia, with IKEA, etc.) instead of on the fleet size. It was agreed to increase the latter by steps, according to the success of the service. Therefore the potential users targeting was fundamental to the success of the service.

As regard the actual functioning of the car sharing, an ICS system was implemented: the users are then able to book the car sharing vehicle by using internet (for example, the website) and, at the same time, the service administration system organizes reservations, considering the time and place chosen by users. The users pick up the car after 24 hours, using their contactless cards. The cars have to be brought back again to the same parking place, once used.

The car sharing service started in March 2010 and its fleet was composed by 6 cars, half powered by natural gas, and 7 reserved parking places located around the city. Before the end of Civitas project, the car sharing counted more than 290 subscribers.

From an impact evaluation view point, due to the small fleet, environmental indicators were not considered significant in relation to emissions reduction in the city. They have been monitored as complementary indicators in order to verify how choices on vehicles typology, potentially influenced by different factors – such as special offers on cars, customer needs, etc., could have an impact on the environment.

The quality of the service and the vehicle occupancy have been assessed through a survey addressed to the Car Sharing subscribers. A very good judgement were made about the service with an awareness level of 29% and an acceptance level of 16% while a mean value of vehicle occupancy equal to 1.7 made evidence of the use of car sharing mostly for individual trips.

It has been also monitored the average modal split, but the small fleet of the car-sharing service resulted to be non-influential towards the modal split of the city, even if this complementary indicator can be useful to monitor citizens less dependency of private car.

Finally, a Cost-Benefit Analysis has been performed to assess from an economic view point the measure. As a result the investment cost by Brescia Municipality (194,000 €) to support the car sharing Civitas measure will be re-paid in 15 years, thanks emission and fuel saving, only if the total kilometres running by car sharing service will be 1,526,420 km. This means that, the car sharing

Measure title: **Car Sharing in Brescia**

City: **BRESCIA**

Project: **MODERN**

Measure number: **06.05**

service, with its low starting (i.e. 16,022 km made in 2010 and 44,142 km in 2011), should have a yearly increase of 28.8% during the next 15 years.

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(HH) High level / longer term:

- To introduce innovative mobility services alternative to private mobility

(II) Strategic level:

- (1) To introduce innovative mobility service integrated with private mobility and PT service,
- (2) To start up the car sharing service in Brescia, to be integrated in the mobility connected to the new metro line.

(JJ) Measure level:

- (1) To start up the car sharing service in Brescia;
- (2) To reach maximum 10 cars;
- (3) To reach maximum 7 reserved parking places;
- (4) To reach about 220 service subscribers;
- (5) A car sharing service for the citizens fully integrated within the Italian network ICS.

### **A2 Description**

Car Sharing service introduces a new mean of transport in Brescia, integrated with other ones, that represents an intelligent way of driving everywhere without financial disadvantages. The car sharing service represented an important innovation as regards the modal split in Brescia, also towards an integrated view of transport systems of the city, linked with both the new metro line realization and the "smart city" image of Brescia.

Considering the medium size of the city and the geographic distribution of its citizens, a study of the needs to be met by car sharing was carried out, as well as a benchmarking to evaluate other car sharing experiences in Italy, to find out the best way to manage the new service. A scheme suitable for Brescia was defined and the tender documents for the award of service was prepared. The company who won the tender (Muovosviluppo s.r.l.) set up a service characterized by the following features:

- hybrid methane/gasoline and gasoline cars;
- ICS tools for the service management;
- accurate localization of the car sharing stations for an optimal intermodality;
- agreements with companies and public bodies for dedicated fares;
- promotional activities (leaflets distribution, web site, etc...).



## B. Measure implementation

### B1 Innovative aspects

- New conceptual approach
- Use of new technology/ITS
- New mode of transport exploited
- Targeting specific user groups.

The innovative aspects of the measure are:

- **Innovative aspect 1 (New conceptual approach)** – From a cultural point of view, car sharing is an innovative mobility service for Brescia and for most Italian realities.
- **Innovative aspect 2 (Use of new technology/ICS)** – For the management of the service (board computer, call centre, card, etc.) the following ICS system (represented by figures 3 and 4), has been used: the users are able to book the car sharing vehicle using internet (for example, the website) and, at the same time, the service administration system organizes reservations, considering the time and place chosen by users. The users can pick up the car after 24 hours, using their contactless cards. The cars will have to be brought back again to the same park place, once used..

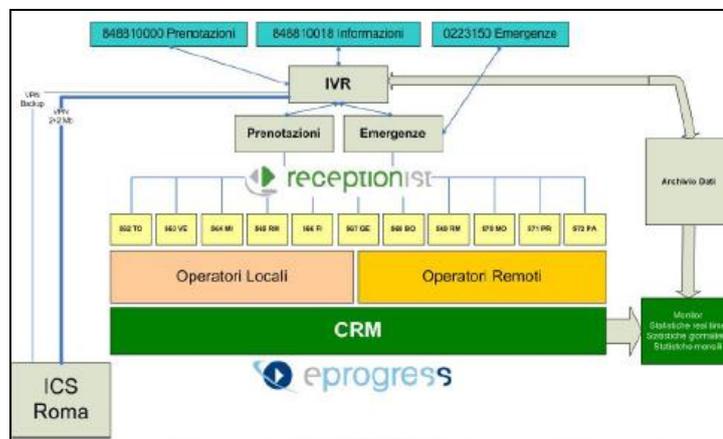
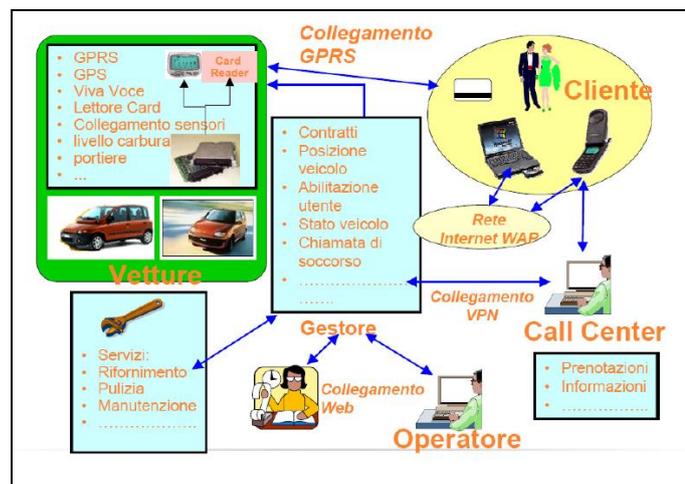


Fig3-4: ICS system: technological infrastructure and information management

- **Innovative aspect 3 (New mode of transport exploited)** – The idea is to try to reduce dependency from the use of private cars and enhance the use of the innovative transport solutions. Indeed, Car Sharing in Brescia can be considered an innovative mode of transport if integrated with other modes of Public Transport such as, bike sharing, TPL and the future Metro line..
- **Innovative aspect 4 (Targeting specific user groups)** – Usually the target users (private customers) are composed by 35-40 aged people. The innovative aspect of the service set up in Brescia is the extension of the target age to 20-50 aged people, in order to reach a total target population of about 2000 users. Car sharing in Brescia tries to involve also other target groups composed by public bodies/companies employees, city users, students, young people, tourists, etc...

## B2 Research and Technology Development

A study of the needs to be met with car sharing has been carried out, as well as a benchmarking to evaluate other car sharing experiences in Italy. The technical project, made by the service manager (Muovosviluppo S.r.l.) took into consideration the ICS system requirements already experimented in other city services and tried to apply the most suitable features for Brescia.

In particular the value of the study is related to the analysis of good practices already implemented in Italy. Also bad practices have been taken in consideration by Muovosviluppo S.r.l. in order to better understand the drivers and barriers encountered during the service management.

In Italy car sharing service (active in Biella, Bologna, Brescia, Firenze, Fossano, Genova, Milano, Padova, Palermo, Parma, Roma, Savona, Scandicci, Sesto Fiorentino, Torino and Venezia) is quite differentiated according to different territorial realities (sometimes was stopped, because in a short time it was proved inefficient (for example, Rimini - experimental site - see figure 5). The main problems are related to the fleet dimensioning in relation to the size of the city. As a consequence, in the case of Brescia, it was decided to focus more on the variety of offers (for eg. hotel – car sharing) and agreements (for eg. with the University of Brescia, IKEA, etc.) instead of on the fleet number. It was agreed to increase the latter by steps according to the success of the service.

City	Start - Stop	n. Cars	n. of subscribers	Parking
Bologna	Ago. 2002	44	1.166	31
Brescia	Feb. 2010	6	187	3
Firenze	Apr. 2005	23	842	28
Genova and Savona	Lug. 2004 - Giu. 2009	78	2.347	55
Milano	Sett. 2001	134	4.882	77
Padova	Sett. 2011	10	40	10
Palermo	Mar. 2009	36	663	44
Parma	Feb. 2007	18	368	12
Rimini (*experimental site)	Summer 2002 (*) Mar.2003	-	-	-
Roma	Mar. 2005	104	2.232	686
Torino	Nov. 2002	121	2.600	82
Venezia	Ago. 2002	44	3.594	12
<b>Tot.</b>		<b>618</b>	<b>18.911</b>	<b>422</b>

*Fig.5 Car sharing managed through ICS in Italy - Data updated at Feb. 2012*  
Source: <http://www.icscarsharing.it>

The optimal localization of the car sharing stations have been carried out following specific guide lines including target groups, GIS studies (influence areas), Local Public Transport and the main urban/suburban “attraction poles”.

### **B3 Situation before CIVITAS**

The setting up of a car sharing service in Brescia was already approached before CIVITAS with no practical results, mainly due to a lack of precise commitment and of a clear framework. Therefore Brescia Municipality decided to implement the measure to try to start up this service together with other sustainable mobility moods such as Metrobus and car pooling. Another driver was the necessity to implement a new smart image of the city as a whole connected to the start up of the Metrobus

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Analysis, definition of the user need and design of the car sharing scheme for Brescia and its approval** (15 October 2008 – 15 January 2009) – *The first step to develop car sharing service in the city consisted in the definition of users needs. This step was considered particularly important to the success of the measure because the city had already invest in car sharing projects without implementing them. The potential users and their geographical distribution, the city characteristics and its mobility, the socio economic distribution of population and business, etc. were analysed to define at best the potential car sharing users and the development plan. A benchmarking – comparison with other Italian car sharing services was made in order to get the final design of the car sharing scheme (procedures, parking spaces locations, tariffs, etc.) including the management scheme.*

**Stage 2: Tender for the selection of the operator and contract service with the operator for the car sharing service development** (15 January 2009 – 15 January 2010) – *The tender was published at the end of December 2008. As no offer arrived from the potential operators a modified version of the tender document was been published in order to increase their interest. To better understand the reason of the failure of the tender, suggestions (through customer methods) were collected and promotional activities also at national level were undertaken. In November 2009 the approval of the offer was signed.*





Fig.8: Map showing the current CS station in Brescia

As already mentioned since its beginning the service manager Muovosviluppo srl has signed agreements with IKEA, Brescia University, Catholic University of the Sacred Heart, Banca Etica, Legambiente, Acli, Arci, Coop, Legacoop Italia, Public bodies, etc. for the reduction of prices.

Even more attention was given to the following targeted categories:

- citizens (families, students, elderly people);
- free lance consultants;
- firms (with 0 a 3 employees,, from 3 to 6 employees, more than 7 employees);
- hotels ( city package tours, outskirts package tours and business package tours).

Some discounts gave been reported in the figure below, as examples:

	entrance fee discount	year's subscription discount	hourly rate	kilometres rate
Public bodies employees	- 50%	- 30%	-	-
University of Brescia and Catholic University students	- 100%	- 70%	-40%	- 40%
University of Brescia and Catholic University employees	- 50%	-10%	- 30%	- 30%
IKEA	- 50%	- 40%	-	-

Fig.9: Example of some discounts for the car sharing service in Brescia

## **B5 Inter-relationships with other measures**

The measure is not related to other Civitas measures. From a strategic point of view it must be underlined that Car Sharing implementation is one of the most important figure for the development of Smart Cities.

## C. Evaluation – methodology and results

From the measure evaluation point of view indicators have been chosen in relation to the expected results at local level, in the view of the Car Sharing realization in Brescia.

### C1 Measurement methodology

Indicators have been divided into two macrocategories: main indicators and complementary indicators (for more information see section C.1.1.).

Main indicators are able to evaluate the measure efficiency in terms of objectives achievement. In addition complementary indicators are introduced in order to assess specific issues. These indicators are relevant only at local level and are used to give additional information in order to better understand the measure performance.

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1.	Economy	Capital Costs	Data provided by "Muovosviluppo srl"	Main Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
2.	Operating Revenues	Average Operating Revenues	Data provided by "Muovosviluppo srl"	Main Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
3.	Operating Costs	Average Operating Costs	Data provided by "Muovosviluppo srl"	Main Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
4.	Fuel Consumption	Vehicles fuel efficiency/km per type of trip	Data of km per type of trip are provided by "Muovosviluppo srl"	Main Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011

5.	Fuel Consumption	Fuel mix / km per type of trip	Data of km per type of trip are provided by "Muovosviluppo srl"	Complementary Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
6.	Emissions	CO <sub>2</sub> emissions/ per type of trip	The value is related to the to the average emissions produced by private car passengers in Italy. The theoretical value is given by the hypothetical fleet proposed by the Muovosviluppo plan	Complementary Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
7.	Emissions	CO emissions/ per type of trip	The value is related to the average emissions produced by private car passengers in Italy. The theoretical value is given by the hypothetical fleet proposed by the Muovosviluppo plan	Complementary Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
8.	Emissions	NOx emissions/ per type of trip	The value is related to the average emissions produced by private car passengers in Italy. The theoretical value is given by the hypothetical fleet proposed by the Muovosviluppo plan	Complementary Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
9.	Emissions	Small particulate emissions/ per type of trip	The value is related to the average emissions produced by private car passengers in Italy. The theoretical value is given by the hypothetical fleet proposed by the Muovosviluppo plan	Complementary Indicator Theoretical ex ante is related to the business plan produced by "Muovosviluppo srl" First data collection after the o.p.: April 2011
10.	Transport	Quality of the service	Survey among CS users	Main Indicator No ex ante foreseen First data collection after the o.p.: June 2011
11.	Transport	Average Modal Split - trips	data coming from ISTAT/SISTAN census referred to 1991-2001	Complementary Indicator The after data collection wasn't carried out because the data coming from

				ISTAT/SISTAN weren't available
12.	Transport	Vehicle Occupancy	Survey among users CS	Main Indicator No ex ante foreseen First data collection after the o.p.: June 2011
13.	Awareness	Awareness Level	CBS questionnaire	Main Indicator First data collection after the o.p.: June 2011
14.	Acceptance	Acceptance Level	CBS questionnaire	Main Indicator First data collection after the o.p.: June 2011

## Detailed description of the indicator methodologies:

- **Indicator 1 (CAPITAL COSTS)** – Capital costs include all the initial investments and the eventual next purchase of equipments useful for the beginning/upgrading of the service. In particular, as regards the car sharing service, initial costs consist in fleet rent, software/hardware purchase and smart cards acquisition. In this case, theoretical value of the ex ante data collection is related to the business plan produced by “Muovosviluppo srl”; the actual value of ex ante is 0, because the service wasn't implemented before Civitas.
- **Indicator 2 (AVERAGE OPERATING REVENUES)** – The indicator “average operating revenues” is defined as the ratio of total incomes generated from fares/tickets divided by the total vehicles/km completed by the service in a given time period (one year). In this case, theoretical value of the ex ante data collection is related to the business plan produced by “Muovosviluppo srl”; the actual value of ex ante is 0, because the service wasn't implemented before Civitas.
- **Indicator 3 (AVERAGE OPERATING COSTS)** - The indicator “average operating costs” is defined as the ratio of total operating costs incurred by the service divided by the total vehicles/km completed by the service in a given time period (one year). In this case, theoretical value of the ex ante data collection is related to the business plan produced by “Muovosviluppo srl”; the actual value of ex ante is 0, because the service wasn't implemented before Civitas.
- **Indicator 4 (VEHICLES FUEL EFFICIENCY/KM PER TYPE OF TRIP)** - This indicator is defined as the energy consumption per unit of transport activity. This derives from the vehicle type and the fuel type. In this case, theoretical value of the ex ante data collection was related to the business plan produced by “Muovosviluppo srl”; the actual value of ex ante was 0, because the service wasn't implemented before Civitas.
- **Indicator 5 (FUEL MIX / KM PER TYPE OF TRIP)** – This indicator is defined as the percentage of the market share of transport fuel for each type of fuel used in a given period (one year). In this case, theoretical value of the ex ante data collection was related to the business plan produced by “Muovosviluppo srl”; the actual value of ex ante was 0, because the service wasn't implemented before Civitas.
- **Indicator 6 (CO2 EMISSIONS/ PER TYPE OF TRIP)** – This indicator is defined as the average CO2 emissions per vehicles/km according to vehicle and fuel types. As regard the emissions estimation, theoretical value of the ex ante data collection is related to the average emissions produced by private car passengers in Italy. Therefore the theoretical value was given by the hypothetical fleet proposed by the Muovosviluppo plan. The actual value of ex ante was 0, because the service wasn't implemented before Civitas.

- **Indicator 7 (CO EMISSIONS/ PER TYPE OF TRIP)** – This indicator is defined as the annual average CO emission per vehicles/km according to vehicle and fuel types. As regard the emissions estimation, theoretical value of the ex ante data collection is related to the average emissions produced by private car passengers in Italy. Therefore the theoretical value was given by the hypothetical fleet proposed by the Muovosviluppo plan. The actual value of ex ante was 0, because the service wasn't implemented before Civitas.
- **Indicator 8 (NOX EMISSIONS/ PER TYPE OF TRIP)** – This indicator is defined as the annual average NOx emission per vehicles/km according to vehicle and fuel types. As regard the emissions estimation, theoretical value of the ex ante data collection is related to the average emissions produced by private car passengers in Italy. Therefore the theoretical value was given by the hypothetical fleet proposed by the Muovosviluppo plan. The actual value of ex ante was 0, because the service wasn't implemented before Civitas.
- **Indicator 9 (SMALL PARTICULATE EMISSIONS/ PER TYPE OF TRIP)** – This indicator is defined as the annual average particulate matter (PM10 and PM2.5) emission. Where possible both Italian laws and COPERT methodology were considered. As regard the emissions estimation, theoretical value of the ex ante data collection is related to the average emissions produced by private car passengers in Italy. Therefore the theoretical value was given by the hypothetical fleet proposed by the Muovosviluppo plan. The actual value of ex ante was 0, because the service wasn't implemented before Civitas.
- **Indicator 10 (QUALITY OF THE SERVICE)** – This indicator is defined as the user's perception of the overall quality of the service provided through a specific survey among the CS users.
- **Indicator 11 (AVERAGE MODAL SPLIT-TRIPS)** – Using data coming from ISTAT/SISTAN census referred to 1991-2001, the modal split for the city of Brescia has been identified. The "modal split" has to be intended as the percentage of how systematic movements (Home-work and home-school) take place inside and outside Brescia.
- **Indicator 12 (VEHICLE OCCUPANCY)** – This indicator considers the average people on board during Car sharing trips.
- **Indicator 13 (AWARENESS LEVEL)** – The calculated indicator is made up of 2 results: the awareness level of the population in relation to the CIVITAS project in general and in relation to Car Sharing. These 2 results are expressed by the percentage of people who has knowledge of a specific aspect respect to the total number of people who answered the questionnaire. The starting question was:  
*"Do you know that in Brescia a Car Sharing service will be implemented?"*
- **Indicator 14 (ACCEPTANCE LEVEL)** – As described for indicator 13, the following question was:  
*"According to your mobility needs, would you be interested in this service?"*

## **C1.2 Establishing a Baseline**

To understand the impact of the measure, a theoretical baseline was established starting from the scenario illustrated in the call for bids won by Muovosviluppo in 2009. As a matter of fact, Muovosviluppo won the call for bids proposed by the Municipality of Brescia, thanks to a five-years plan which aimed to the promotion of the Car Sharing service in Brescia. For this purpose, the company made a comparative analysis among different Car Sharing experiences in Italy, which

became the theoretical baseline for the evaluation of Car sharing.

The theoretical indicators reported in the following table have been calculated starting from the data which can be found in the Muovosviluppo plan.

Indicators related to tender	Theoretical baseline (2009)	Real baseline
1.Capital Costs (for the car sharing service)	32.328 €	0€ (no service)
2.Average Operating Revenues (for the car sharing service)	0,71 €/vkm	0€ (no service)
3.Average Operating Costs (for the car sharing service)	2,16 €/vkm	0€ (no service)

*Tab.1: indicator 1, 2 and 3 baseline*

Indicators related to the plan fleet structure	Theoretical baseline (2009)	Real baseline
4. Vehicles fuel efficiency/km per type of trip	2,74 MJ/vKm	0 (no service)
5. Fuel mix / km per type of trip	Average energy consumption for the vehicles using Methan gas/Gasoline 2,72875 MJ/Km; Average energy consumption by the vehicles using Gasoline 2,747 MJ/Km	0 (no service)

*Tab.2: indicator 4 and 5 baseline*

As regards the emissions estimation, the baseline was referred to the average emissions produced by private car passengers in Italy; the theoretical baseline was given by the hypothetical fleet proposed by the Muovosviluppo plan.

Indicators	Theoretical Baseline (business plan)	Baseline 2008 (National data)
6.CO2 emissions/ per type of trip	Ministry methodology: 133,88 g/vkm TREMOVE: 170,22 g/vkm	164,1 gCO <sub>2</sub> /vkm (*)
7.CO emissions/ per type of trip	7,2 g/vkm	2,272 gCO/vkm (**)
8.NOx emissions/ per type of trip	1,2 g/vkm	0,638 gNO <sub>x</sub> /vkm (***)
9.Small particulate emissions/ per type of trip	(PM 2,5) = 0,0018 g/vkm	0,054 gPM <sub>2,5</sub> /vkm (****)

Notes: The theoretical baseline refers to the Muovosviluppo business Plan fleet; The Baseline is referred to average national data taken from the following sources: ISPRA environmental yearbook edition 2009 and National Transport and infrastructure count - edition 2008/2009. Data referred to year 2008

ISPRA, "Annuario dati ambientali edizione 2009";

Ministero delle Infrastrutture e dei Trasporti, "Conto Nazionale delle Infrastrutture e dei Trasporti - Anni 2008-2009.

(\*) ISPRA yearbook table 3.42;

(\*\*) Estimation of the CO using data coming from the ISPRA yearbook (tables 6.15, 3.3, 3.28 – year 2007)

(\*\*\*) Estimation of the NO<sub>x</sub> using data coming from the national count (table VIII.5.2.2) and from the ISPRA yearbook

(table 3.28)

(\*\*\*) Estimation of the PM2,5 using data coming from the ISPRA yearbook (tables 3.9 and 3.28 – year 2007)

*Tab.3: indicator 6,7,8,and 9 baseline*

As regard indicator 11 Average Modal Split – trips, data proposed by the new Brescia Master Plan (PGT) were used; indicator 12 represented the average vehicle occupancy in Italy (source: Ministero infrastrutture e dei trasporti, "Conto Nazionale delle infrastrutture e dei trasporti - Anni 2008-2009").

Indicators	Baseline (2008)
11. Average Modal Split – trips (PGT)	On foot 9,9 % Bicycle 2,4 % PTW 3,0 % Car 58,3 % Bus 23,8 % Train 2,6 %
12. Vehicle Occupancy	1,7 passengers/vehicle (National data)

*Tab.4: indicator 11 and 12 baseline*

Indicator 10 had no baseline; indicators 13 and 14 represented the interest shown by citizens for Car Sharing in Brescia.

Indicators	Baseline
10. Quality of the service	none
13. Awareness Level <i>Do you know that in Brescia a Car Sharing service will be implemented?</i>	No 619 (89%) Yes 74 (11%)
14. Acceptance Level <i>According to your mobility needs, would you be interested into this service?</i>	No 631 (91%) Yes 62 (9%)

*Tab.5: indicator 10, 13 and 14 baseline*

### C1.3 Building the Business-as-Usual scenario

As everybody know, the Car Sharing service didn't exist in Brescia before CIVITAS. Since the beginning of the 90s, besides some researches deepening the issue of the metro transport system, several proposals for the reduction of the private passenger cars use in the city were evaluated. Some solutions, such as for example the introduction of the LAM for busses ("high mobility lanes", i.e. dedicated bus lanes) and the realization of bicycle lanes/itineraries were put into operation during the previous administration. Other solutions, such as Car Sharing and Car Pooling were recently considered priority projects for the city, also in view of the considerable financial investments made for the new metrobus construction. Bike Sharing service in Brescia was activated in 2008 under the new administration.

Bike Sharing service has been particularly effective because Brescia can be crossed by bike in a short time in competition also with the bus,. It is favoured also by the difficulties in finding free parking especially in the areas near the railway station.

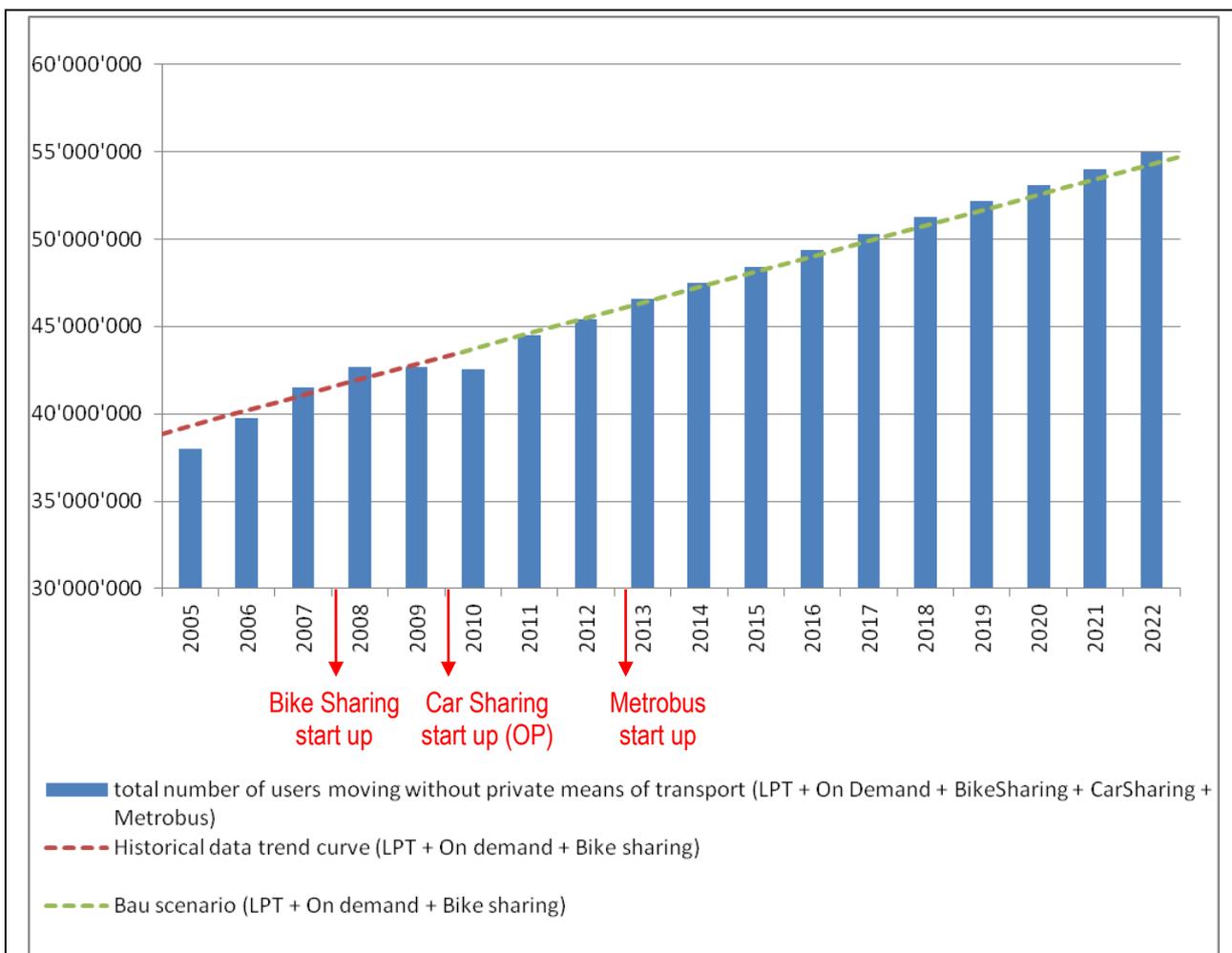
Bike sharing has been considered an alternative solution to private car use, the service can also be addressed to those citizens who need to move in the city or to reach particular services.. Also intermodal split areas can be properly provided with bike sharing stations. For example in the

historical centre there are 15 bike sharing stations - excluding those set along the ring road, with a total number of 149 bikes; at the railway station there is 1 bike sharing station offering 30 bikes and at the general hospital there are 2 stations with a total number of 19 bikes.

Deepening the different sustainable mobility solutions offered and promoted by the city of Brescia in order to empower the public transport service, the following policies emerge:

- 1) to improve the local public transport mobility realizing dedicated bus lanes along the most important bus creating which cross the city from North to South (LAM);
- 2) to promote public transport services toward specific kinds of users (like for example H-bus for disabled people or School busses for students);
- 3) to favour the use of bicycles creating cycle lanes and providing Bike Sharing.

The BaU scenario construction is based on the assumptions mentioned above, namely the maintenance and the strengthening of the mobility policies of the city. It's important to stress the fact that such actions are addressed predominantly to improve the overall mobility conditions for the citizens moving in the urban centre and for the city users along the main traffic directions approaching the city (see point 1,2,3 mentioned above).



Note: The total number of LPT users takes in account also the number of the foreseen metrobus passengers (the data are based on the documentation used for metrobus tender). Instead the passenger contribution of the bus, Bike Sharing, Car Sharing and On demand services has been estimated singularly, projecting the respective historical data series. The baseline trend curve has been

calculated considering data up to February 2010 (start up Car Sharing service). The baseline situation considers the total number of bus, on demand and bike sharing services users.

*Fig.10: LPT, Bike Sharing, Car Sharing and On demand services BaU scenario*

It should be assumed that without Civitas the car sharing service would never have started, therefore the main indicators related to the service will be “0” both the ones related to the tender and the ones related to the plan fleet structure.

Indicators related to tender	BaU 2012
1.Capital Costs (for the car sharing service)	0 € (no service)
2.Average Operating Revenues (for the car sharing service)	0 € (no service)
3.Average Operating Costs (for the car sharing service)	0 € (no service)

*Tab.6: indicator 1, 2 and 3 BaU*

Indicators related to the plan fleet structure (car sharing)	BaU 2012
4. Vehicles fuel efficiency/km per type of trip	0 (no service)
5. Fuel mix / km per type of trip	0 (no service)

*Tab.7: indicator 4 and 5 BaU*

For the same reason also main indicators measuring the impact on society will be “0” because the service won’t be implemented without Civitas and no questionnaire would have been administered.

Indicators	BaU
10.Quality of the service	0 (no service)
13.Awareness Level <i>Do you know that in Brescia a Car Sharing service will be implemented?</i>	0 (no service)
14.Acceptance Level <i>According to your mobility needs, would you be interested into this service?</i>	0 (no service)

*Tab.8: indicator 10, 13 and 14 BaU*

For complementary indicators the BAU was calculated starting from the fleet proposed by Muovosviluppo using the emission data foreseen in ISPRA environmental data yearbook and in the “national transport and infrastructure count” (year 2009).

In this case the BAU is useful to compare the fleet proposed for Brescia with the Italian “passenger car fleet”.

Indicators	BaU 2012 (National data 2009)
6. CO2 emissions/ per type of trip	161,8 gCO <sub>2</sub> /vkm (*)
7.CO emissions/ per type of trip	1,95 gCO/vkm (**)
8.NOx emissions/ per type of trip	0,57 g/vkm (***)
9.Small particulate emissions/ per type of trip	0,0397 g/vkm (****)
Notes: Data sources for the BaU scenario is the ISPRA environmental data yearbook and the “national transport and infrastructure count”, referred to year 2009 ISPRA, “Annuario dati ambientali edizione 2010”; Ministero delle Infrastrutture e dei Trasporti, “Conto Nazionale delle Infrastrutture e dei Trasporti - Anni 2009-2010”. (* ) ISPRA yearbook table 3.39; (** ) Estimation of the CO using data coming from the ISPRA yearbook (tables 6.25, 3.3, 3.27 – year 2008) (*** ) Estimation of the NOx using data coming from the national count (table VIII.5.2.2) and from the ISPRA yearbook (table 3.27) (**** ) Estimation of the PM2,5 using data coming from the ISPRA yearbook (tables 3.9 and 3.27 – year 2008) Complementary indicators	

*Tab.9: indicator 6, 7, 8 and 9 BaU*

As regard complementary indicator 11 Average Modal Split – trips, data proposed by the new Brescia Master Plan (PGT) are used; while indicator 12 represents the average vehicle occupancy in Italy (source: Ministero infrastrutture e dei trasporti, "Conto Nazionale delle infrastrutture e dei trasporti - Anni 2009-2010").

Indicators	Bau 2012
11. Average Modal Split – trips (PGT)	On foot 9,9 % Bicycle 3,4 % PTW 3,0 % Car 58 % Bus 23,1% Train 2,6 %
12.Vehicle Occupancy	1,7 passengers/vehicle (National data)

*Tab.10: indicator 11 and 12 BaU*

## C2 Measure results

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

### C2.1 Economy

Table C2.1.1: **Results obtained for the Indicators corresponding to area “economy”**

•

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U
1. Capital Costs	No Ex Ante foreseen  (From the Business Plan – theoretical value; October 2009: 32.328 €)	March 2010/March 2011: 89.668 €	March 2010/March 2011: 0 € (no service)	Not Assessable	Not Assessable
		March 2011/March 2012: 49.839 €	March 2011/March 2012: 0 € (no service)	Not Assessable	Not Assessable
2. Average Operating Revenues	No Ex Ante foreseen  (From the Business Plan – theoretical value; October 2009: 0,71 €/vkm)	March 2010/March 2011: 1,49€/vkm	March 2010/March 2011: 0 €/vkm (no service)	Not Assessable	Not Assessable
		March 2011/March 2012: 1,24 €/vkm	March 2011/March 2012: 0 €/vkm (no service)	Not Assessable	Not Assessable
3. Average Operating Costs	No Ex Ante foreseen  (From the Business Plan – theoretical value; October 2009: 2,16 €/vkm)	March 2010/March 2011: 6,57 €/vkm	March 2010/March 2011: 0/vkm € (no service)	Not Assessable	Not Assessable
		March 2011/March 2012: 12,60 €/vkm	March 2011/March 2012: 0/vkm € (no service)	Not Assessable	Not Assessable

•

• As regards the economic indicators 1 “Capital Costs” and 2 “Average Operating Revenues” and 3 “Average Operating Costs”, by the comparison between the theoretical value reported in the Business Plan (*Muovosviluppo Business Plan, 2009*) and the actual values, some observations were listed:

- - there was a general underestimation of the “Capital Costs”, in particular in the costs of the SW service (estimated about 5.000€/year instead of about 65.000€ in the first year and about 32.000€ in the second year) .
- - there was a general overestimation of the “Average Operating Revenues”, in particular due to an overestimation of the kilometres yearly made by the fleet.
- - regarding the Operating Costs it should be underlined that there were less operating costs due to the real kilometres yearly made by the fleet. The service therefore was pricey than expected.

**C2.2 Energy**

Table C2.2.1: **Results obtained for the Indicators corresponding to area “energy”**

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U
4. Vehicles fuel efficiency/km per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; 2,74 MJ/vKm)	March 2010/March 2011: 2,51 MJ/vKm	March 2010/March 2011: 0 MJ/vKm	Not Assessable	Not Assessable
		March 2011/March 2012: 2,53 MJ/vKm	March 2011/March 2012: 0 MJ/vKm	Not Assessable	Not Assessable
5. Fuel mix / km per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; Average energy consumption for the vehicles using Methan gas/Gasoline 2,72875 MJ/Km Average energy consumption by the vehicles using Gasoline 2,747 MJ/Km)	March 2010/March 2011: Average energy consumption for the vehicles using Methan gas/Gasoline 2,6376667 MJ/Km	March 2010/March 2011: Average energy consumption for the vehicles using Methan gas/Gasoline 0 MJ/Km	Not Assessable	Not Assessable
		Average energy consumption by the vehicles using Gasoline 2,5793333 MJ/Km	Average energy consumption by the vehicles using Gasoline 0 MJ/Km		
		March 2011/March 2012: Average energy consumption for the vehicles using Methane gas/Gasoline 2,6376667 MJ/Km	March 2011/March 2012: Average energy consumption for the vehicles using Methane gas/Gasoline 0 MJ/Km	Not Assessable	Not Assessable
		Average energy consumption by the vehicles using Gasoline 2,5793333	Average energy consumption by the vehicles using Gasoline 0 MJ/Km		

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U
		MJ/Km			

The energy consumption, estimated by indicators 4 “Vehicles fuel efficiency/km per type of trip” and 5 “Fuel mix / km per type of trip” registered lower values than the Business Plan ones.

Indicator 4 “Vehicles fuel efficiency/km per type of trip” is lower than estimated due to the less number of kilometres yearly made by the fleet. Besides the slight increasing of kilometres done by the fleet 2011-2012 is balanced by the increasing of fuel costs.

- Indicator 5 “Fuel mix / km per type of trip” made evidence of the real composition of the fleet and of its real fuel consumption.

### C2.3 Environment

Table C2.3.1: Results obtained for the Indicators corresponding to area “environment”

- 

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U
6. CO <sub>2</sub> emissions/ per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; Ministry methodology: 133,88 g/vkm REMOVE: 170,22 g/vkm)	March 2010/March 2011: Ministry methodology: 126,50 g/vkm REMOVE: 165,16 g/vkm	March 2010/March 2011: 161,8 gCO <sub>2</sub> /vkm	Not Assessable	+ 3,36 g/vkm
		March 2011/March 2012: Ministry methodology: 126,50 g/vkm REMOVE: 165,16 g/vkm	March 2011/March 2012: 161,8 gCO <sub>2</sub> /vkm	Not Assessable	+ 3,36 g/vkm
7. CO emissions/ per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; 7,2 g/vkm)	March 2010/March 2011: 7,19 g/vkm	March 2010/March 2011: 1,95 g/vkm	Not Assessable	+ 5,24 g/vkm
		March 2011/March 2012: 7,19 g/vkm	March 2011/March 2012: 1,95 g/vkm	Not Assessable	+ 5,24 g/vkm
8. NO <sub>x</sub> emissions/ per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; 1,2	March 2010/March 2011: 1,13 g/vkm	March 2010/March 2011: 0,57 g/vkm	Not Assessable	+ 0,56 g/vkm
		March 2011/March 2012: 1,13	March 2011/March 2012: 0,57	Not Assessable	+ 0,56 g/vkm

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U
	g/vkm)	g/vkm	g/vkm		
9. Small particulate emissions/ per type of trip	No Ex Ante foreseen  (From the business plan – theoretical value; (PM 2,5) 0,0018 g/vkm)	March 2010/March 2011: (PM 2,5) 0,0018 g/vkm	March 2010/March 2011: 0,0397 g/vkm	Not Assessable	- 379 0,0 g/vkm
		March 2011/March 2012: (PM 2,5) 0,0018 g/vkm	March 2010/March 2011: 0,0397 g/vkm	Not Assessable	- 379 0,0 g/vkm

Due to the small fleet environmental indicators were not considered significant in relation to emissions reduction in the city.

They were monitored as complementary indicators in order to verify how choices on vehicles typology, that could be influenced by different factors – such as special offers on cars, customer needs, etc., could have an impact on the environment. Brescia fleet has little differences in emissions respect the one estimated in the Business Plan.

## C2.4 Transport

Table C2.4.1: Results obtained for the Indicators corresponding to area “transport”

•

Indicator	Before	After	BaU	Difference: After –Before	Difference: After – B-a-U																
10. Quality of the service	No Ex Ante foreseen	June 2011: <table border="1"> <thead> <tr> <th>Rating</th> <th>%</th> </tr> </thead> <tbody> <tr> <td>Excellent</td> <td>22</td> </tr> <tr> <td>Very good</td> <td>67</td> </tr> <tr> <td>Good</td> <td>11</td> </tr> <tr> <td>Sufficient</td> <td>0</td> </tr> <tr> <td>Mediocre</td> <td>0</td> </tr> <tr> <td>Not Answered</td> <td>0</td> </tr> <tr> <td>TOTAL</td> <td>100</td> </tr> </tbody> </table>	Rating	%	Excellent	22	Very good	67	Good	11	Sufficient	0	Mediocre	0	Not Answered	0	TOTAL	100	June 2011: 0 (no service)	Not Assessable	Not Assessable
		Rating	%																		
Excellent	22																				
Very good	67																				
Good	11																				
Sufficient	0																				
Mediocre	0																				
Not Answered	0																				
TOTAL	100																				
		April 2012 <table border="1"> <thead> <tr> <th>Rating</th> <th>%</th> </tr> </thead> <tbody> <tr> <td>Excellent</td> <td>16,7</td> </tr> <tr> <td>Very good</td> <td>55,5</td> </tr> <tr> <td>Good</td> <td>27,8</td> </tr> <tr> <td>Sufficient</td> <td>0</td> </tr> <tr> <td>Mediocre</td> <td>0</td> </tr> <tr> <td>Not Answered</td> <td>0</td> </tr> <tr> <td>TOTAL</td> <td>100</td> </tr> </tbody> </table>	Rating	%	Excellent	16,7	Very good	55,5	Good	27,8	Sufficient	0	Mediocre	0	Not Answered	0	TOTAL	100	April 2012: 0 (no service)	Not Assessable	Not Assessable
Rating	%																				
Excellent	16,7																				
Very good	55,5																				
Good	27,8																				
Sufficient	0																				
Mediocre	0																				
Not Answered	0																				
TOTAL	100																				
11. Average Modal Split - trips	(2008) On foot 9,9 % Bicycle 2,4 %	Not Assessable	(2012): On foot 9,9 % Bicycle 3,4 %	Not Assessable	Not Assessable																

Indicator	Before	After	BaU	Difference: After – Before	Difference: After – B-a-U
	PTW 3,0 % Car 58,3 % Bus 23,8 % Train 2,6 %		PTW 3,0 % Car 57,3 % Bus 23,8 % Train 2,6 %		
12. Vehicle Occupancy	No Ex Ante foreseen	June 2011 2 pass/car	June 2011: 1,7 pass/car	Not Assessable	+ 0,3 pass/car
		April 2012 1,57 pass/car	April 2012: 1,7 pass/car	Not Assessable	- 0,13 pass/car

Indicators 10 “Quality of the service“ and 12 “Vehicle Occupancy” were collected through a survey addressed to the Car Sharing subscribers.

The survey was filled in mainly by new subscribers and a very good judgement were made about the service.

Indicator 12 “Vehicle Occupancy” made evidence of the use of car sharing for individual trips. Regarding Indicator 11 “Average modal split – trips” the small fleet have no influence on the modal split of the city, this complementary indicator is useful in order to monitor citizens less dependency of private car. As a matter of fact its reduction can favour car sharing development, individual attitude in using the car is evident also from indicator 12 “Vehicle Occupancy”.

## C2.5 Society

Table C2.5.1: Results obtained for the Indicators corresponding to area “society”

Indicator	Before	After	BaU	Difference: After – Before	Difference: After – B-a-U
13. Awareness Level	January 2010: 11%	April 2011: 11%	April 2011: 0 (no service)	+ 0%	+ 11%
		April 2012: 29%	April 2012: 0 (no service)	+ 18%	+ 29%
14. Acceptance Level	January 2010: 9%	April 2011: 13%	April 2011: 0 (no service)	+ 4%	+ 13%
		April 2012: 16%	April 2012: 0 (no service)	+ 7%	+ 16%

- 

- There is a general increment in both acceptance and awareness of the service this fact can be considered related to:

- general dissemination activities carried out systematically by Muovosviluppo;
- targeted campaigns and targeted offers made by Muovosviluppo;
- a general good experience done by the present car sharing users

- ICS (Initiative Car Sharing) membership, that is well known at National level.

### Summary of the main CBA results (ref. Annex 3)

As this was considered a focus measure, a CBA was carried out, comparing the hypothetic situation without the car sharing service (reference case or Business-as-Usual scenario) with the actual present situation, including the implementation of the Car Sharing Civitas Measure (Car Sharing scenario). The reference year was set 2010, in which a private Company, charged by the Municipality of Brescia, implemented and managed the car sharing service in the city. The whole period, taken into consideration by CBA to have a financing return, was set in 15 years (final CBA year: 2025).

The investment cost by Brescia Municipality (194,000 €) to support the car sharing Civitas measure was re-paid in 15 years, thanks emission and fuel saving, only if the total kms running by car sharing service were 1,526,420 kms. This means that, the car sharing service, with the low starting (2010 and 2011 monitorings: 16,022 kms and 44,142 kms), should increase yearly in the next 15 years of 28,8%,

In fact, only with this use increasing, the Net Present Value and the Benefit/Costs Ratio became respectively up zero and up one in 15 years.

### C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Start up the car sharing service in Brescia This objective can be considered achieved in full, as the Car Sharing service was kicked off in March 2010.	**
2	Reach maximum 10 cars This objective can be considered substantially achieved. <i>In fact the Car Sharing fleet is composed by 6 vehicles (April 2012)</i>	*
3	Reach maximum 7 reserved parking places This objective can be considered exceeded. <i>As a matter of fact, the Car Sharing service has 7 reserved parking places.</i>	***
4	Reach about 220 service subscribers. This objective can be considered exceeded. <i>As a matter of fact, the Car Sharing service subscribers were more than 290 (data referred to May 2012).</i>	***
5	A car sharing service for the citizens fully integrated within the Italian network ICS This objective can be considered achieved in full. <i>As a matter of fact, the Car Sharing service was integrated to the existing ICS Italian network.</i>	**
<b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b> <b>** = Achieved in full    *** = Exceeded</b>		

## **C4 Up-scaling of results**

The car sharing service implemented in Brescia is already available for all ICS subscribers and to all Muovosviluppo subscribers. As a matter of fact the fleet is used all over the city and out of it.

## **C5 Appraisal of evaluation approach**

The evaluation activities consisted in the data collection to calculate the selected indicators for the ex ante/ex post situation. The chosen set of indicators was subdivided into five categories: *Economy, Energy, Environment, Transport* and *Society*.

In the first one, the indicators regarded “Capital costs”, “Average operating Revenues” and “costs” were chosen in order to collect information about the management of the service. These data were useful also for the CBA drawing up, as this was a focused measure.

As regards the categories *Energy* and *Environment*, they were considered as complementary indicators relevant only at local level and not representative of the measure effectiveness on the city:

The indicators of the category *Transport* were chosen in order to monitor the quality of the car sharing service (indicator 10) and the use of the service itself (indicator 12 “vehicle occupancy”).

These information was provided by Muovosviluppo S.r.l., through on-line questionnaire addressed to the service subscribers.

The indicator 11 “average modal split per trip”\_ is based on ISTAT/SISTAN (National Italian Statistic) census.

Finally, indicators related to the category *Society* regarded the “Awareness” and the “Acceptance” of the citizens about the Car sharing service. These information was provided through a specific section of the questionnaire of the Municipality of Brescia, which regarded several Civitas measures.

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – start up of Brescia car sharing service in March 2010, the service is managed by Muovosviluppo S.r.l.
- **Key result 2** – as regards the service, it was implemented with a fleet composed by six cars, half powered by natural gas; also, 7 reserved parking places were located in the city and the service reached more than 290 subscribers (data referred to May 2012).
- **Key result 3** - the car sharing service implemented in Brescia was fully integrated within the Italian network ICS (“Initiative Car Sharing”), in order to better link different cities with the car sharing service and to make standard the service in Italy (also as regards the car reservation procedure). As a matter of fact, the subscribers of different cities are able to use the service wherever it is implemented and integrated in ICS network.

## **C7 Future activities relating to the measure**

The future activities related to the measure consist in upgrading of the service implementation trough:

- enlargement of the fleet purchasing also electric cars (taking in account customers suggestions);
- new fares depending on the service use agreed with companies
- enlargement of parking areas dedicated to Car Sharing to be located also in relation to the new PT network organization (the start up of the new metroline is foreseen by 2013 with a substantial reorganisation of LPT transport in Brescia).

## D. Process Evaluation Findings

### D.0 Focused measure

This measure was chosen as a focused one at the beginning of the project. The reasons of this choice are reported below:

1	The possibility of carrying out a good Cost Benefit Analysis;
2	The measure fitted into the city policy towards sustainable urban transport and/or towards sustainability in general;
3	The measure was considered as an example measure.

### D1 Deviations from the original plan

- **Number of cars** - The deviation from the original plan pointed out for this measure regarded the number of the cars of the fleet: in fact, a fleet of 10 cars was foreseen, but actual number of the cars was equal to 6.

### D2 Barriers and drivers

#### D2.1 Barriers

##### Preparation phase

- **Planning barrier** –No one attended the first tender. Therefore the tender description was reviewed and refined by the Municipality of Brescia

##### Operational phase

- **Other barrier (service organization barrier)** - it was important to highlight that, considering the limited size of the car sharing fleet, the cars should be parked where it is taken. This was considered a barrier by users.

#### D2.2 Drivers

##### Preparation phase

- **Political/strategic driver** – Municipality of Brescia implemented the car sharing service in the city, due to the strong will to implement sustainable mobility in the city. This allowed also to develop a new smart and clean image of the Brescia.

##### Implementation phase

- **Spatial driver** - The good design and the localization of car sharing parking spaces helped to improve the service and to make it desirable for citizens.

##### Operational phase

- **Involvement driver** - Muovosviluppo shown a excellent flexibility towards the possible stakeholders (companies, public bodies, etc.). As a matter of fact, the company involved

several partners with personalized agreements, with different fares and discounts for employees, as personal use.

- **Involvement driver** – the activities carried out during the European Mobility Week allowed increasing involvement of citizens and users through campaigns.

## **D2.3 Activities**

### **Preparation phase**

- **New tender** - As regards the first tender failure, a second tender was fulfilled: as a matter of fact, the tender terms were changed, in order to public a more tempting one for the possible competitors.

### **Operational phase**

- **Car sharing as a strategic activity for the city** - An important step consisted in including the car sharing service implementation into a running sustainability program (combined with the strategic actions).

## **D3 Participation**

### **D.3.1 Measure partners**

- **Muovosviluppo s.r.l** - as it was the winner of the second tender. The company managed the service (cars, on line reservation, ICS service integration, etc.) and the promotional targeted campaigns and the agreements with the several stakeholders in the city.

### **D.3.2 Stakeholders**

- **Brescia citizens** - they were all potential users of the service, considering that it was implemented in all the city; in particular, they were involved in many dissemination campaigns, carried out also during the "European sustainable mobility week".
- **IKEA, Brescia University, Catholic University of the Sacred Heart, Banca Etica, Legambiente, Acli, Arci, Coop, Legacoop Italia, Public bodies, hotels etc.**- these were considered all stakeholders and the car sharing company Muovosviluppo carried out particular arrangements and discounts addressed to them.

## **D4 Recommendations**

### **D.4.1 Recommendations: measure replication**

- **“Market oriented” perspective** - The car sharing service in Italy is organized according to very precise standards and operational procedures which capitalized an experience of more than 10 years. They cover all the aspects of a car sharing service, from the technological equipment to the contact center for the customers, from contractual forms to fares and penalties, from vehicles availability to service procedures and so on. The Brescia service is compliant with these standards, procedures and norms, and consequently is transferrable in a “market oriented” perspective. In fact it represents a consolidated service model which could be implemented in other realities..

#### **D.4.2 Recommendations: process**

- **Targeted dissemination campaigns** – considering that Brescia is a middle sized city, with a high property car rate, the targeted dissemination campaign is important, in order to better improve the service awareness and acceptance among the citizens; actually, it's difficult to target different groups of people, to which address the information campaign as they can be potentially interested to the car sharing service.
- **Investigate the interest among specialized companies** – before the implementation phase of a car sharing service, it's important to investigate the interest among the companies, which manage this kind of service, in order to draw up a desirable tender, more suitable both for the city and for the involved companies.
- **Integration with existing and new means of transport** – the localization of the reserved parking places is fundamental for the service success and for the subscribers increase. As a matter of fact, an in-depth study of the parking location allow the transport integration among different means of transport: this can help people to move in the city without their own car and to reach easily the car sharing stations.
- **Integration with existing Car Sharing network** – it's important to highlight that a car sharing service works better if fully integrated with the national car sharing network (if it existing).
- **Targeted agreements and discounts** – the agreements drawing up among the company and several categories (Public bodies, Universities, big companies, cooperatives, etc.) is important for the car sharing implementation, because it make more attractive the service for several categories, characterized by different needs of transport. Furthermore, it will help the spread of information about the implemented service.

## Annex 1: Data used for the BaU building

The following data series has been used to build the graph showing the estimation of the total number of users moving without private means of transport reported in the section C1.3“Building the BaU scenario”. That graph has been built in order to make overall considerations about a more general BaU scenario referred to the mobility solutions (already existing, new and future ) offered by the city of Brescia.

Year	2005	2006	2007	2008	2009	2010
<b>TPL passengers</b>	38'008'558	39'760'208	41'459'439	42'692'823	42'668'471	42'553'535
<b>On demand service passengers</b>	14'977	16'569	17'143	16'473	16'649	16'097
<b>Bike sharing subscribers</b>	0	0	0	1040	1753	3149
<b>total number of users moving without private means of transport (LPT + On Demand + BikeSharing)</b>	38'023'535	39'776'777	41'476'582	42'710'336	42'686'873	42'572'781

Tab.A1.1: Data series used to build the graph showing the estimation of the total number of users moving without private means of transport

Data about the Car Sharing service passengers is available at the moment only for year 2011 and is 30 passengers.

Data about the metro passengers are taken from the simulations reported in the metrobus technical documents.

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
<b>estimated metro passengers</b>	215120	219422	223725	230178	232330	234481	236632	236632	236632	236632

Tab.A1.2: Estimated metro passengers

## Annex 2: Ex ante and Ex Post data collection

- **Indicator 1 (Capital Costs)** – The ex ante is calculated using data provided by the business plan coming from the service operator. The business plan has been produced by “Muovosviluppo srl”, a company coming from Padova, in occasion of their participation to the tender.

CONTO ECONOMICO		Anno 1
<b>RICAVI (Fatturato + Contributi)</b>	€	<b>261.823</b>
<b>FATTURATO</b>	€	<b>79.859</b>
Da entry fees aziendali	€	5.000
Da abbonamenti	€	14.908
Da tempo	€	23.439
Da Km	€	36.512
Contributo ICS	€	181.964
<b>COSTI TOTALI</b>	€	<b>322.677</b>
<b>COSTI FLOTTA</b>	€	<b>55.802</b>
Noleggio	€	20.708
RC-I-F-K- Tassa Prop.	€	13.806
Carburante	€	6.720
Lavaggi	€	1.968
Posti auto	€	-
Attrezzaggio posti auto (amm)	€	3.000
Call center	€	9.600
<b>IT</b>	€	<b>21.620</b>
Computer di bordo	€	2.720
Sw- Server (amm)	€	5.000
Smart- card	€	900
Altra IT	€	13.000
<b>LAVORO</b>	€	<b>48.000</b>
Responsabile operativo	€	15.000
R & S clienti	€	-
Amministrazione / Gestione	€	27.000
Personale esterno (outsourcing)	€	6.000
<b>ALTRI COSTI</b>	€	<b>197.255</b>
RIDI	€	-
Climaneutralità	€	547
Marketing 1to1	€	30.000
Pubblicità	€	100.064
Attrezzaggio sede (amm)	€	-
Consulenze esterne	€	5.000
Adempimenti societari	€	3.000
PT + Phone	€	1.000
Enel	€	4.100
Affitto sede	€	6.000
Corsi di formazione	€	35.000
Cancelleria e modulistica	€	-
Legali	€	8.000
Manutenzione e varie	€	4.544
<b>DEBITI</b>	€	<b>90.982</b>
Oneri /Proventi finanziari sui debiti	€	2.243
<b>RISULTATO GESTIONALE ANTE IMPOSTE</b>	-€	<b>63.097</b>
<b>RISULTATO CUMULATO</b>	€	<b>63.097</b>

Tab.A2.1.: Extract from the business plan provided by the operator service

As can be seen in the table reported above, the indicator can be built through the sum of the following costs:

Capital costs	€
---------------	---

Fleet rent	20.708 €
Auto parking equipment	3.000 €
Computer on board	2.720 €
Software server	5.000 €
Smart cards	900 €
<b>TOTAL</b>	<b>32.328 €</b>

Tab.A2.2: data provided by the business plan coming from the service operator

***AFTER DATA COLLECTION referred to the period March 2010 – March 2011:***

<b>Capital costs</b>	<b>€</b>
Fleet rent	15.486 €
Auto parking equipment	0.00 €
Computer on board	6.113 €
Software server	64.069 €
Smart cards	4.000 €
<b>TOTAL</b>	<b>89.668 €</b>

Tab.A2.3: data provided by the service operator

***AFTER DATA COLLECTION referred to the period March 2011 – March 2012:***

<b>Capital costs</b>	<b>€</b>
Fleet rent	15.777 €
Auto parking equipment	0.00 €
Computer on board	1.597 €
Software server	31.252 €
Smart cards	1.213 €
<b>TOTAL</b>	<b>49.839 €</b>

Tab.A2.4: data provided by the service operator

- **Indicator 2 (Average Operating Revenues)** - As regards the data source, it can be taken in consideration the same business plan described above (indicator 1) and in particular the same table reported. The indicator is built as follows:

$$A = B/C$$

A = Average operational revenues for the service = 0,71 €/vkm  
 B = Total operational revenues for the service = 79.859 €  
 C = Total vehicle kms for the service in the first year= 112.000 vkm

(data provided by the business plan coming from the service operator).

***AFTER DATA COLLECTION referred to the period March 2010 – March 2011:***

$$A = B/C$$

A = Average operational revenues for the service = 1,49 €/vkm  
 B = Total operational revenues for the service = 28.833,53 €  
 C = Total vehicle kms for the service = 19.389 vkm

(data provided by the service operator)

***AFTER DATA COLLECTION referred to the period March 2011 – March 2012:***

$$A = B/C$$

A = Average operational revenues for the service = 1,24 €/vkm  
 B = Total operational revenues for the service = 67.159,39 €  
 C = Total vehicle kms for the service = 54.313vkm

(data provided by the service operator)

- **Indicator 3 (Average Operating Costs)** - As regards the data source, it can be taken in consideration the same business plan described above (indicator 1) and in particular the same table reported . The indicator is built as follows:

$$A = B/C$$

A = Average operating costs for the service = 2,16 €/vkm  
 B = Total operating costs for the service = 242.349 €  
 C = Total vehicle kms for the service in the first year = 112.000 vkm

Operating costs	€
Insurance taxes “RC”	13.806
Fuel	6.720
Car washes	1.968
Call centre	9.600
Personnel costs	48.000
Other costs	162.255
<b>TOTAL</b>	<b>242.349 €</b>

Tab.A2.5: data provided by the business plan coming from the service operator

***AFTER DATA COLLECTION referred to the period March 2010 – March 2011:***

$$A = B/C$$

A = Average operating costs for the service = 6,57 €/vkm

B = Total operating costs for the service = 127.475 €

C = Total vehicle kms for the service = 19.389 vkm

<b>Operating costs</b>	<b>€</b>
Insurance taxes "RC"	10.324
Fuel	612,73
Car washes	452,60
Call centre	8.812,85
Personnel costs	25.513,20
Other costs	81.759,30
<b>TOTAL</b>	<b>127.475€</b>

Tab.A2.6: data provided by the service operator

***AFTER DATA COLLECTION referred to the period March 2011 – March 2012:***

$$A = B/C$$

A = Average operating costs for the service = 2,60 €/vkm

B = Total operating costs for the service = 141.497,37 €

C = Total vehicle kms for the service = 54.313 vkm

<b>Operating costs</b>	<b>€</b>
Insurance taxes "RC"	16.450
Fuel	7.037,03
Car washes	576,00
Call centre	4.695,49
Personnel costs	17.380,00
Other costs	95.088,85
<b>TOTAL</b>	<b>141.497,37€</b>

Tab.A2.7: data provided by the service operator

- **Indicator 4 (Vehicles fuel efficiency/km per type of trip)** – The fleet, for the first year (as explained in the business plan) is composed by 8 vehicles and is composed by the following vehicles:

n. 2	Fiat Panda 1.2 Dynamic N.P.	Metano / Benzina	City car / City car compatte
n. 2	Fiat 500 1.2 Pop	Benzina	City car / City car compatte
n. 1	Fiat Punto Classic 1.2 N.P.	Metano / Benzina	City car / City car compatte
n. 1	Opel Zafira 1.6 16v ecoM	Metano / Benzina	Berline / Berline piccolo
n. 1	Fiat Doblò 1.4 Actual	Benzina	Vetture multifunzione trasporto persone e/o merci
n. 1	Fiat Doblò 1.4 Active	Benzina	City car / City car compatte Allestita per il trasporto Disabili

Tab.A2.8: Business plan fleet vehicles

To calculate this indicator the “Guide for the fuel saving and about the CO2 emissions<sup>20</sup>” has been taken as reference. This Guide has been released as regulation for the implementation of the European Directive 1999/94/CE<sup>21</sup> thanks to the collaboration among 3 Italian Government Departments: Ministero delle Attività Produttive, Ministero dell’Ambiente e della tutela del territorio e Ministero delle Infrastrutture e dei Trasporti (the picture below shows an extract of the tables that can be found in the Guide). The guide lines include for many car models several information, such as fuel consumption and CO2 emissions. Sometimes, information taken directly from the car producers have been taken as reference. Using calorific power for each kind of fuel, it has been possible to estimate the indicator, according to the formula below:

$$A = B/C$$

A = Average vehicle energy efficiency

B = Total energy consumed by the fleet

C = Total amount vehicle kms completed by the vehicles for the service = 112.000 vkm \*

\* data provided by the business plan coming from the service operator

<b>Fuel type and unit of measure</b>	<b>Calorific power [MJ/l MJ/Nm<sup>3</sup> MJ/kWh]</b>
Gasoline [l]	44
Gasoil [l]	42,5
Methan gas [m <sup>3</sup> ]	33,4
Electric [kWh]	3600
<i>Methan gas density</i>	<i>0,71 [kg/mc]</i>

Tab.A2.9: Fuel type and unit of measure

It’s important to remark that indicator 4 can be expressed by the weighted average energy consumption (MJ/vkm) calculated for the Car Sharing fleet respect to the kms driven by each kind of car.

As regard the ex ante situation (given by the business plan analysis) we have the total kms driven by the whole hypothetical Car Sharing Fleet, therefore the indicator coincides with the average energy consumption.

<sup>20</sup> [http://www.consumieclima.org/download/guida\\_risparmio\\_carburante\\_emissionico2.pdf](http://www.consumieclima.org/download/guida_risparmio_carburante_emissionico2.pdf)

<sup>21</sup> DPR 17 febbraio 2003 n.84 “Regolamento di attuazione della direttiva n. 1999/94/CE

As regard the AFTER data collection, referred to the period March 2010 - March 2011, we know the actual kms driven by each car composing the car sharing fleet, therefore indicator 4 can be calculated using a weighted average.

Each vehicle consumes the following amount of energy:

Type of car	Fuel	consumption misto (Kg/100Km) or (l/100km)		Energy Consumption (MJ/km)	
		Methan gas	Gasoline		
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	4,8 Kg/100Km	6,2 (l/100km)	2,25	2,728
				2,489	
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	4,8 Kg/100Km	6,2 (l/100km)	2,25	2,728
				2,489	
Fiat 500 1.2 Pop	Gasoline	5,1 l/100 km		2,244	
Fiat 500 1.2 Pop	Gasoline	5,1 l/100 km		2,244	
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	6,6 Kg/100Km	6,3 (l/100km)	3,1	2,77
				2,935	
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	5,2 Kg/100Km	8,10 (l/100km)	2,44	3,564
				3,002	
Fiat doblò 1.4 Actual	Gasoline	7,4 (l/100km)		3,25	
Fiat doblò 1.4 Active	Gasoline	7,4 (l/100km)		3,25	
<b>Average Energy Consumption (MJ/km)</b>				<b>2,737875</b>	

Tab.A2.10: Average Energy Consumption (MJ/km)

**AFTER DATA COLLECTION referred to the period March 2010 – March 2011:**

New fleet composition:

Type of car	Fuel	consumption misto (Kg/100Km) or (l/100km)		Average Energy Consumption (MJ/km)		Vkm driven by each kind of car	Energy consumed by the fleet [MJ]
		Methan gas	Gasoline				
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	4,8 Kg/100Km	6,2 (l/100km)	2,25	2,728	1.239	3.083,871
				2,489			
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	4,8 Kg/100Km	6,2 (l/100km)	2,25	2,728	3.971	9.883,819
				2,489			
Fiat 500 1.2 Pop	Gasoline	5,1 l/100 km		2,244		4.961	11.132,484
Fiat 500 1.2 Pop	Gasoline	5,1 l/100 km		2,244		4.754	10.667,976
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	6,6 Kg/100Km	6,3 (l/100km)	3,1	2,77	1.873	5.497,255
				2,935			

Fiat doblò 1.4 Actual	Gasoline	7,4 (l/100km)	3,25	2.591	8.420,75
<b>Totals</b>				19.389	48.686,155

Tab.A2.11: Energy Consumption of the fleet (MJ)

B = Total energy consumed by the fleet = 48.686,155 MJ

C = Total amount vehicle kms completed by the vehicles for the service = 19.389 km

A = Weighted average vehicle energy efficiency = 2,51 MJ/vkm

**AFTER DATA COLLECTION referred to the period March 2011 – March 2012:**

As regard the second AFTER data collection, referred to the period March 2011 - March 2012, we know the actual kms driven by each car composing the car sharing fleet (two Fiat Panda 1.2 Dynamic N.P, two Fiat 500 1.2 Pop, Fiat Punto classic 1.2 N.P. and Fiat doblò 1.4 Actual), therefore indicator 4 can be calculated using a weighted average.

Fleet composition:

Type of car	Fuel	consumption misto (Kg/100Km)or(l/100km)		Average Energy Consumption (MJ/km)		Vkm driven by each kind of car	Energy consumed by the fleet [MJ]
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	Methan gas 4,8 Kg/100Km	Gasoline 6,2 (l/100km)	2,25	2,728	17.208	42.830,71
				2,489			
Fiat 500 1.2 Pop	Gasoline	5,1 l/100 km		2,244		22.473	50.429,41
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	6,6 Kg/100Km	6,3 (l/100km)	3,1	2,77	9.879	28.994,86
				2,935			
Fiat doblò 1.4 Actual	Gasoline	7,4 (l/100km)		3,25		4.753	15.447,25
<b>Totals</b>						54.313	137.701,69

Tab.A2.12: Energy Consumption of the fleet (MJ)

B = Total energy consumed by the fleet = 137.702,23 MJ

C = Total amount vehicle kms completed by the vehicles for the service = 54.313 km

A = Weighted average vehicle energy efficiency = 2,53 MJ/vkm

- **Indicator 5 (Fuel mix / km per type of trip)** – This indicator can be considered as the average energy consumption per km, sorting by kind of fuel. According to the table reported above (indicator 4),

Type of car	Fuel	Energy consumption (MJ/km)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	2,489
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	2,489
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	2,935

Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	3,002
<b>Average energy consumption for the vehicles using Methan gas/Gasoline</b>		<b>2,72875</b>
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat doblò 1.4 Actual	Gasoline	3,25
Fiat doblò 1.4 Active	Gasoline	3,25
<b>Average energy consumption by the vehicles using Gasoline</b>		<b>2,747</b>
<b>Average energy consumption for the fleet</b>		<b>2,737875</b>

Tab.A2.13: Data are provided by the operator service and have been taken from the business plan.

**AFTER DATA COLLECTION referred to the period March 2010 – March 2011:**

Type of car	Fuel	Energy consumption (MJ/km)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	2,489
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	2,489
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	2,935
<b>Average energy consumption for the vehicles using Methan gas/Gasoline</b>		<b>2,6376667</b>
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat doblò 1.4 Actual	Gasoline	3,25
<b>Average energy consumption by the vehicles using Gasoline</b>		<b>2,5793333</b>

Tab.A2.13: Average energy consumption by the vehicles using Gasoline

**AFTER DATA COLLECTION referred to the period March 2011 – March 2012:**

Type of car	Fuel	Energy consumption (MJ/km)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	2,489
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	2,489
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	2,935
<b>Average energy consumption for the vehicles using Methan gas/Gasoline</b>		<b>2,6376667</b>
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat 500 1.2 Pop	Gasoline	2,244
Fiat doblò 1.4 Actual	Gasoline	3,25
<b>Average energy consumption by the vehicles using Gasoline</b>		<b>2,5793333</b>

Tab.A2.14: Average energy consumption by the vehicles using Gasoline

- Indicator 6 (CO2 emissions/ per type of trip)** – Both Italian laws (Ministry guide lines) and REMOVE methodology are considered (Data which are required to run COPERT in different countries have been collected in the framework of the project “European Database of Vehicle Stock for the Calculation and Forecast of Pollutant and Greenhouse Gases Emissions with REMOVE and COPERT” funded by the European Commission – DG Environment and executed by a consortium consisting of LAT/AUTH, KTI, Renault, E3M-Lab/NTUA, Oekopol, and EnviCon.).

For each type of vehicle is considered the CO2 emissions.

Using the Ministry methodology, the following table is to be considered to calculate the CO<sub>2</sub> emissions for passenger cars for each kind of vehicle:

According to the values suggested by the Ministry methodology or cars constructors, the CO<sub>2</sub> average emissions produced by the fleet (considering only Gasoline powered cars, that produce ), are:

Type of car	Fuel	CO2 emissions (g/vkm)
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	119
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	138
Fiat 500 1.2 Pop	Gasoline	119
Fiat 500 1.2 Pop	Gasoline	119
Fiat doblò 1.4 Actual	Gasoline	174
Fiat doblò 1.4 Active	Gasoline	174
<b>Average CO2 emissions produced by the fleet (g/vkm)</b>		<b>133,88</b>

Tab.A2.15: Average CO2 emissions produced by the fleet (g/vkm)

Using the REMOVE methodology, the following table is to be considered to calculate the CO<sub>2</sub> emissions for passenger cars for each kind of vehicle:

<b>CO2 Emission (g/v km) for passenger cars</b>		
Type	Labelling	CO2
Gasoline	Euro 0	289,95
Gasoline	Euro 1	202,21
Gasoline	Euro 2	194,48
Gasoline	Euro 3	181,24
Gasoline	Euro 4	170,22
Gasoline	Euro 5	160,10
Diesel	Euro 0	192,03
Diesel	Euro 1	203,87
Diesel	Euro 2	190,72
Diesel	Euro 3	174,52
Diesel	Euro 4	153,66

Diesel	Euro 5	161,95
Diesel	Euro 6	161,84

Tab.A2.16: CO2 Emission (g/v km) for passenger cars

According to the table above, the CO<sub>2</sub> average emissions produced by the fleet (hypothesized in the business plan) are reported below:

Type of car	Fuel	Labeling (Euro)	CO2 emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	170,22 g/vkm
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	170,22 g/vkm
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 4	170,22 g/vkm
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	EURO 4	170,22 g/vkm
Fiat 500 1.2 Pop	Gasoline	EURO 4	170,22 g/vkm
Fiat 500 1.2 Pop	Gasoline	EURO 4	170,22 g/vkm
Fiat doblò 1.4 Actual	Gasoline	EURO 4	170,22 g/vkm
Fiat doblò 1.4 Active	Gasoline	EURO 4	170,22 g/vkm
<b>AverageCO2 emissions produced by the fleet (g/vkm)</b>			<b>170,22 g/vkm</b>

Tab.A2.17: Average CO2 emissions produced by the fleet (g/vkm)

**AFTER DATA COLLECTION referred to the period March 2010 – March 2011:**

**Ministry methodology:**

Type of car	Fuel	CO2 emissions (g/vkm)
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	119
Fiat 500 1.2 Pop	Gasoline	119
Fiat 500 1.2 Pop	Gasoline	119
Fiat doblò 1.4 Actual	Gasoline	174
<b>Average CO2 emissions produced by the fleet (g/vkm)</b>		<b>126,50</b>

**Tremove methodology:**

Type of car	Fuel	Labeling (Euro)	CO2 emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	170,22
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	170,22
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	160,1
Fiat 500 1.2 Pop	Gasoline	EURO 5	160,1

Fiat 500 1.2 Pop	Gasoline	EURO 5	160,1
Fiat doblò 1.4 Actual	Gasoline	EURO 4	170,22
<b>AverageCO2 emissions produced by the fleet (g/vkm)</b>			<b>165,16</b>

Tab.A2.18-19: Average CO2 emissions produced by the fleet (g/vkm)

**AFTER DATA COLLECTION referred to the period March 2011 – March 2012:**

**Ministry methodology:**

Type of car	Fuel	CO2 emissions (g/vkm)
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Panda 1.2 Dynamic N.P.	Methan gas/Gasoline	114
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	119
Fiat 500 1.2 Pop	Gasoline	119
Fiat 500 1.2 Pop	Gasoline	119
Fiat doblò 1.4 Actual	Gasoline	174
<b>Average CO2 emissions produced by the fleet (g/vkm)</b>		<b>126,50</b>

**Tremove methodology:**

Type of car	Fuel	Labeling (Euro)	CO2 emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	170,22
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	170,22
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	160,1
Fiat 500 1.2 Pop	Gasoline	EURO 5	160,1
Fiat 500 1.2 Pop	Gasoline	EURO 5	160,1
Fiat doblò 1.4 Actual	Gasoline	EURO 4	170,22
<b>AverageCO2 emissions produced by the fleet (g/vkm)</b>			<b>165,16</b>

Tab.A2.20-21: Average CO2 emissions produced by the fleet (g/vkm)

- **Indicator 7 (CO emissions/ per type of trip)** – This indicator is defined as the annual average CO emission per vehicles-km by vehicle and fuel types. For each type of vehicle is considered the CO emissions.

Using the COPERT methodology, the following table is to be considered to calculate the emission factor for passenger cars for each kind of vehicle:

Measure title: **Car Sharing in Brescia**

City: **BRESCIA**

Project: **MODERN**

Measure number: **06.05**

Emission factors for passenger cars					Source : COPERT IV			
Type	Technology	CO	NMVOC	NOx	N2O	NH3	Pb	PM2.5
Units	g/km	g/km	g/km	g/km	g/km	g/km		g/km
Notes		Given as THC-CH4	Given as NO2 equivalent					
Gasoline <1.4 l	PRE ECE	39.2	3.65	1.89	0.010	0.0025	1.33E-06	0.0024
Gasoline <1.4 l	ECE 15/00-01	30.5	3.05	1.89	0.010	0.0025	1.14E-06	0.0024
Gasoline <1.4 l	ECE 15/02	22.8	2.94	2.06	0.010	0.0025	1.09E-06	0.0024
Gasoline <1.4 l	ECE 15/03	23.2	2.94	2.23	0.010	0.0025	1.09E-06	0.0024
Gasoline <1.4 l	ECE 15/04	13.6	2.51	2.02	0.010	0.0025	9.71E-07	0.0024
Gasoline <1.4 l	Open Loop	11.9	2.22	1.49	0.010	0.0025	1.04E-06	0.0024
Gasoline <1.4 l	PC Euro 1 -91/441/EEC	4.23	0.564	0.441	0.023	0.0731	9.37E-07	0.0024
Gasoline <1.4 l	PC Euro 2 -94/12/EEC	2.39	0.301	0.242	0.012	0.0958	9.28E-07	0.0024
Gasoline <1.4 l	PC Euro 3 -98/69/EC I	2.14	0.169	0.098	0.005	0.0276	9.50E-07	0.0011
Gasoline <1.4 l	PC Euro 4 -98/69/EC II	0.710	0.123	0.062	0.005	0.0276	9.95E-07	0.0011
Gasoline 1.4 - 2.0 l	PRE ECE	39.2	3.80	2.47	0.010	0.0025	1.60E-06	0.0024
Gasoline 1.4 - 2.0 l	ECE 15/00-01	30.5	3.19	2.47	0.010	0.0025	1.34E-06	0.0024
Gasoline 1.4 - 2.0 l	ECE 15/02	22.8	3.081	2.33	0.010	0.0025	1.28E-06	0.0024
Gasoline 1.4 - 2.0 l	ECE 15/03	23.2	3.08	2.43	0.010	0.0025	1.28E-06	0.0024
Gasoline 1.4 - 2.0 l	ECE 15/04	13.8	2.66	2.58	0.010	0.0025	1.14E-06	0.0024
Gasoline 1.4 - 2.0 l	Open Loop	6.68	1.73	1.26	0.010	0.0025	1.25E-06	0.0024
Gasoline 1.4 - 2.0 l	PC Euro 1 -91/441/EEC	3.93	0.645	0.441	0.023	0.0731	1.12E-06	0.0024
Gasoline 1.4 - 2.0 l	PC Euro 2 -94/12/EEC	2.18	0.349	0.243	0.012	0.0958	1.09E-06	0.0024
Gasoline 1.4 - 2.0 l	PC Euro 3 -98/69/EC I	1.96	0.193	0.098	0.005	0.0276	1.14E-06	0.0011
Gasoline 1.4 - 2.0 l	PC Euro 4 -98/69/EC II	0.658	0.136	0.062	0.005	0.0276	1.17E-06	0.0011
Gasoline >2.0 l	PRE ECE	39.2	4.01	3.70	0.010	0.0025	1.94E-06	0.0024
Gasoline >2.0 l	ECE 15/00-01	30.5	3.41	3.70	0.010	0.0025	1.50E-06	0.0024
Gasoline >2.0 l	ECE 15/02	22.8	3.30	2.62	0.010	0.0025	1.58E-06	0.0024
Gasoline >2.0 l	ECE 15/03	23.2	3.30	3.44	0.010	0.0025	1.58E-06	0.0024

Measure title: **Car Sharing in Brescia**

City: **BRESCIA**

Project: **MODERN**

Measure number: **06.05**

Emission factors for passenger cars				Source : COPERT IV				
Type	Technology	CO	NM VOC	NOx	N2O	NH3	Pb	PM2.5
Units	g/km	g/km	g/km	g/km	g/km	g/km		g/km
Notes		Given as THC-CH4	Given as NO2 equivalent					
Gasoline >2.0 l	ECE 15/04	13.8	3.51	2.80	0.010	0.0025	1.44E-06	0.0024
Gasoline >2.0 l	PC Euro 1 -91/441/EEC	3.33	0.520	0.419	0.023	0.0731	1.43E-06	0.0024
Gasoline >2.0 l	PC Euro 2 -94/12/EEC	1.74	0.273	0.226	0.012	0.0958	1.49E-06	0.0024
Gasoline >2.0 l	PC Euro 3 -98/69/EC I	1.58	0.157	0.091	0.005	0.0276	1.35E-06	0.0011
Gasoline >2.0 l	PC Euro 4 -98/69/EC II	0.549	0.116	0.058	0.005	0.0276	1.59E-06	0.0011
Diesel <2.0 l	Conventional	0.713	0.162	0.561	0.000	0.0012	2.04E-06	0.246
Diesel <2.0 l	PC Euro 1 -91/441/EEC	0.449	0.051	0.691	0.003	0.0012	1.77E-06	0.0877
Diesel <2.0 l	PC Euro 2 -94/12/EEC	0.333	0.036	0.726	0.006	0.0012	1.85E-06	0.0594
Diesel <2.0 l	PC Euro 3 -98/69/EC I	0.097	0.020	0.780	0.010	0.0012	1.74E-06	0.0412
Diesel <2.0 l	PC Euro 4 -98/69/EC II	0.097	0.016	0.601	0.010	0.0012	1.74E-06	0.0342
Diesel >2.0 l	Conventional	0.713	0.162	0.890	0.000	0.0012	2.04E-06	0.246
Diesel >2.0 l	PC Euro 1 -91/441/EEC	0.449	0.077	0.691	0.003	0.0012	2.39E-06	0.0877
Diesel >2.0 l	PC Euro 2 -94/12/EEC	0.333	0.110	0.726	0.006	0.0012	2.39E-06	0.0594
Diesel >2.0 l	PC Euro 3 -98/69/EC I	0.097	0.019	0.780	0.010	0.0012	2.39E-06	0.0412
Diesel >2.0 l	PC Euro 4 -98/69/EC II	0.097	0.016	0.601	0.010	0.0012	2.39E-06	0.0342
LPG	Conventional	6.75	1.10	2.31	0.000	0.0100	n.a.	n.a.
LPG	PC Euro 1 -91/441/EEC	3.80	0.771	0.444	0.024	0.0230	n.a.	n.a.
LPG	PC Euro 2 -94/12/EEC	2.65	0.369	0.199	0.013	0.0120	n.a.	n.a.
LPG	PC Euro 3 -98/69/EC I	2.22	0.206	0.115	0.005	0.0050	n.a.	n.a.
LPG	PC Euro 4 -98/69/EC II	1.04	0.100	0.063	0.005	0.0050	n.a.	n.a.
2-Stroke	Conventional	13.1	10.0	0.642	0.008	0.0019	n.a.	n.a.
Hybrid Gas 1.4-2.0 l	PC Euro 4 -98/69/EC II	0.001	0.021	0.009	0.005	0.0276	n.a.	n.a.

Tab.A2.22: Emission factors for passenger cars

According to the table above, the CO average emissions produced by the fleet (hypothized in the business plan) are reported below:

Type of car	Fuel	Labeling (Euro)	CO emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 4	0,71
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	EURO 4	0,658
Fiat 500 1.2 Pop	Gasoline	EURO 4	13,6
Fiat 500 1.2 Pop	Gasoline	EURO 4	13,6
Fiat doblò 1.4 Actual	Gasoline	EURO 4	13,8
Fiat doblò 1.4 Active	Gasoline	EURO 4	13,8
<b>AverageCO emissions produced by the fleet (g/vkm)</b>			<b>7,2 g/vkm</b>

Tab.A2.23: Average CO emissions produced by the fleet (g/vkm)

*AFTER DATA COLLECTION referred to the period March 2010 – March 2011:*

Type of car	Fuel	Labeling (Euro)	CO emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,71
Fiat 500 1.2 Pop	Gasoline	EURO 5	13,6
Fiat 500 1.2 Pop	Gasoline	EURO 5	13,6
Fiat doblò 1.4 Actual	Gasoline	EURO 4	13,8
<b>AverageCO emissions produced by the fleet (g/vkm)</b>			<b>7,19</b>

Tab.A2.24: Average CO emissions produced by the fleet (g/vkm)

*AFTER DATA COLLECTION referred to the period March 2011 – March 2012:*

Type of car	Fuel	Labeling (Euro)	CO emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,71
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,71
Fiat 500 1.2 Pop	Gasoline	EURO 5	13,6
Fiat 500 1.2 Pop	Gasoline	EURO 5	13,6
Fiat doblò 1.4 Actual	Gasoline	EURO 4	13,8
<b>AverageCO emissions produced by the fleet (g/vkm)</b>			<b>7,19</b>

Tab.A2.25: Average CO emissions produced by the fleet (g/vkm)

- **Indicator 8 (NOx emissions/ per type of trip)** – For each type of vehicle is considered the NOx emissions.

Using the COPERT methodology, the following table is to be considered to calculate the NOx emissions for passenger cars for each kind of vehicle:

Type of car	Fuel	Labeling (Euro)	NOx emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 4	0,062
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	EURO 4	0,062
Fiat 500 1.2 Pop	Gasoline	EURO 4	2,02
Fiat 500 1.2 Pop	Gasoline	EURO 4	2,02
Fiat doblò 1.4 Actual	Gasoline	EURO 4	2,58
Fiat doblò 1.4 Active	Gasoline	EURO 4	2,58
<b>Average NOx emissions produced by the fleet (g/vkm)</b>			<b>1,2 g/vkm</b>

Tab.A2.26: Average NOx emissions produced by the fleet (g/vkm)

*AFTER DATA COLLECTION referred to the period March 2010 – March 2011:*

Type of car	Fuel	Labeling (Euro)	NOx emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,062
Fiat 500 1.2 Pop	Gasoline	EURO 5	2,02
Fiat 500 1.2 Pop	Gasoline	EURO 5	2,02
Fiat doblò 1.4 Actual	Gasoline	EURO 4	2,58
<b>Average NOx emissions produced by the fleet (g/vkm)</b>			<b>1,13</b>

Tab.A2.27: Average NOx emissions produced by the fleet (g/vkm)

*AFTER DATA COLLECTION referred to the period March 2011 – March 2012:*

Type of car	Fuel	Labeling (Euro)	NOx emissions (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,062
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,062
Fiat 500 1.2 Pop	Gasoline	EURO 5	2,02
Fiat 500 1.2 Pop	Gasoline	EURO 5	2,02
Fiat doblò 1.4 Actual	Gasoline	EURO 4	2,58

<b>Average NOx emissions produced by the fleet (g/vkm)</b>	<b>1,13</b>
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Tab.A2.28: Average NOx emissions produced by the fleet (g/vkm)

- **Indicator 9 (Small particulate emissions/ per type of trip)** – For each type of vehicle is considered the PM2.5 emissions.

Using the COPERT methodology, the following table is to be considered to calculate the Particulate concentrations for passenger cars for each kind of vehicle:

Type of car	Fuel	Labeling (Euro)	Particulate concentrations (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 4	0,0011
Opel Zafira 1.6 16v ecoM	Methan gas/Gasoline	EURO 4	0,0011
Fiat 500 1.2 Pop	Gasoline	EURO 4	0,0024
Fiat 500 1.2 Pop	Gasoline	EURO 4	0,0024
Fiat doblò 1.4 Actual	Gasoline	EURO 4	0,0024
Fiat doblò 1.4 Active	Gasoline	EURO 4	0,0024
<b>Average Particulate concentrations produced by the fleet (g/vkm)</b>			<b>0,0018 g/vkm</b>

Tab.A2.29: Average particulate concentrations emissions produced by the fleet (g/vkm)

**AFTER DATA COLLECTION referred to the period March 2010 – March 2011:**

Type of car	Fuel	Labeling (Euro)	Particulate concentrations (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,0011
Fiat 500 1.2 Pop	Gasoline	EURO 5	0,0024
Fiat 500 1.2 Pop	Gasoline	EURO 5	0,0024
Fiat doblò 1.4 Active	Gasoline	EURO 4	0,0024
<b>Average Particulate concentrations produced by the fleet (g/vkm)</b>			<b>0,0018</b>

Tab.A2.30: Average particulate concentrations emissions produced by the fleet (g/vkm)

**AFTER DATA COLLECTION referred to the period March 2011 – March 2012:**

Type of car	Fuel	Labeling (Euro)	Particulate concentrations (g/vkm)
Fiat Panda 1.2 ynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Panda 1.2Dynamic N.P.	Methan gas/Gasoline	EURO 4	0,0011
Fiat Punto classic 1.2 N.P.	Methan gas/Gasoline	EURO 5	0,0011
Fiat 500 1.2 Pop	Gasoline	EURO 5	0,0024
Fiat 500 1.2 Pop	Gasoline	EURO 5	0,0024
Fiat doblò 1.4 Active	Gasoline	EURO 4	0,0024
<b>Average Particulate concentrations produced by the fleet (g/vkm)</b>			<b>0,0018</b>

Tab.A2.31: Average particulate concentrations emissions produced by the fleet (g/vkm)

- **Indicator 10 (Quality of the service)** – This indicator is defined as the user’s perception of the overall quality of the service provided and is collected through a specific survey among the CS users.

#### FIRST DATA COLLECTION (JUNE 2011)

Data to be collected for this indicator can derive both from a survey lead in internet open to everyone (on the Car Sharing dedicated web site) and newsletter sent to the subscribers. The survey was lead in June 2011 (the first newsletter was sent on 1<sup>st</sup> June and a second one on 24<sup>th</sup> June). Notwithstanding the involvement of people, only 10 of the 30 CS users (18% of the total number of subscribers) answered the questionnaire. The specific question able to monitor the quality of service is “How do you rate the quality of car sharing service”? The perception of the service quality has been measured on a five-point scale, such as: Excellent, Very good, Good, Sufficient, Mediocre. The obtained results are the following:

Rating	%
Excellent	22
Very good	67
Good	11
Sufficient	0
Mediocre	0
Not Answered	0
TOTAL	100

Tab.A2.32: The perception of the service quality

#### SECOND DATA COLLECTION (APRIL 2012)

Data to be collected for this indicator can derive both from a survey lead in internet open to everyone (on the Car Sharing dedicated web site). The survey was lead in April 2012, only 18 of the 287 CS users answered the questionnaire. The specific question able to monitor the quality of service is “How do you rate the quality of car sharing service”? The perception of the service quality has been

measured on a five-point scale, such as: Excellent, Very good, Good, Sufficient, Mediocre. The obtained results are the following:

<b>Rating</b>	<b>%</b>
Excellent	16,7
Very good	55,5
Good	27,8
Sufficient	0
Mediocre	0
Not Answered	0
<b>TOTAL</b>	<b>100</b>

Tab.A2.33: The perception of the service quality

- Indicator 11 (Average Modal Split - trips)** – The “modal split” has to be intended as the percentage of how systematic movements (Home-work and home-school) take place inside Brescia and from outside. Using data coming from ISTAT/SISTAN census referred to 1991-2001, the modal split for the city of Brescia has been settled.

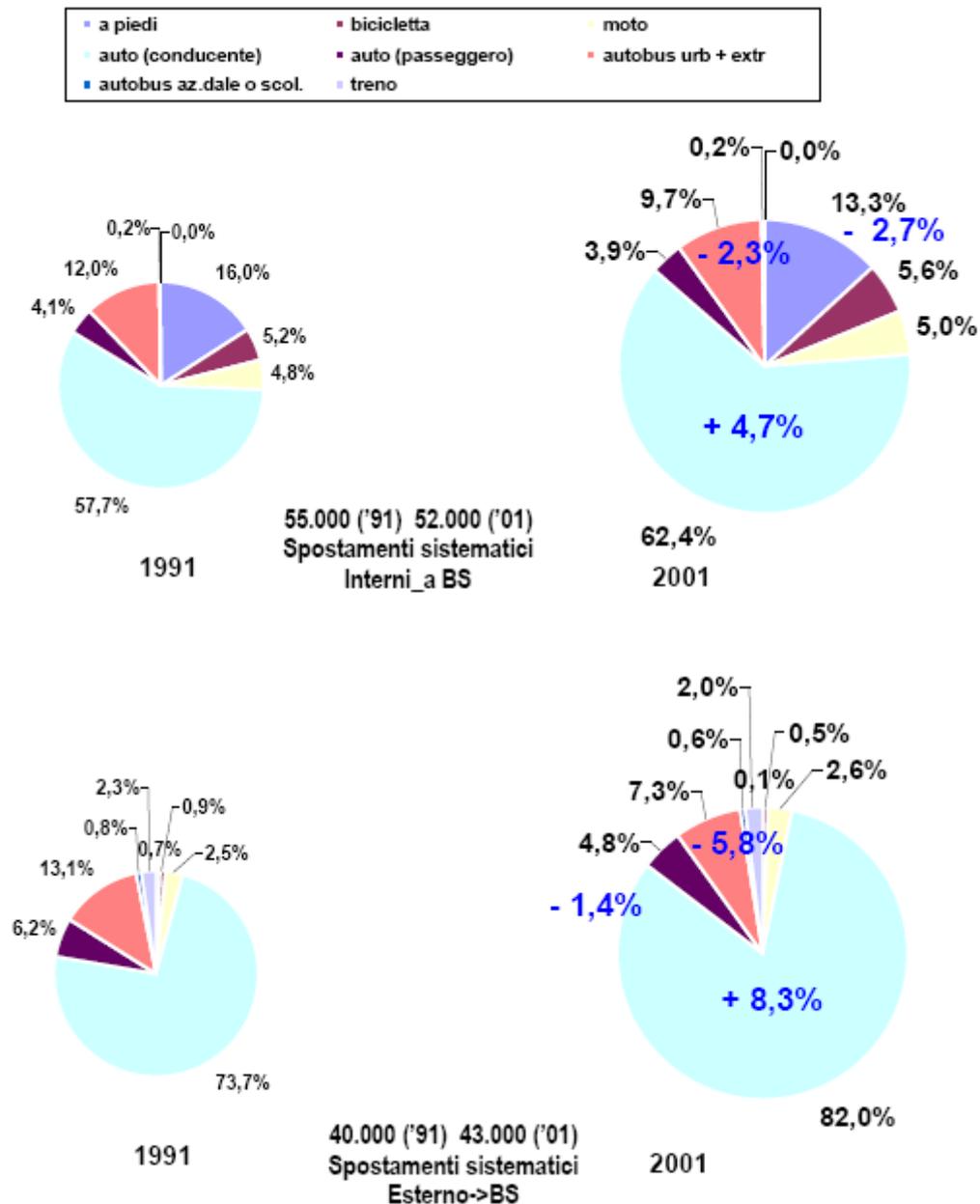


Fig.A2.1: Modal split referred to the home-work systematic movements internal and external to Brescia

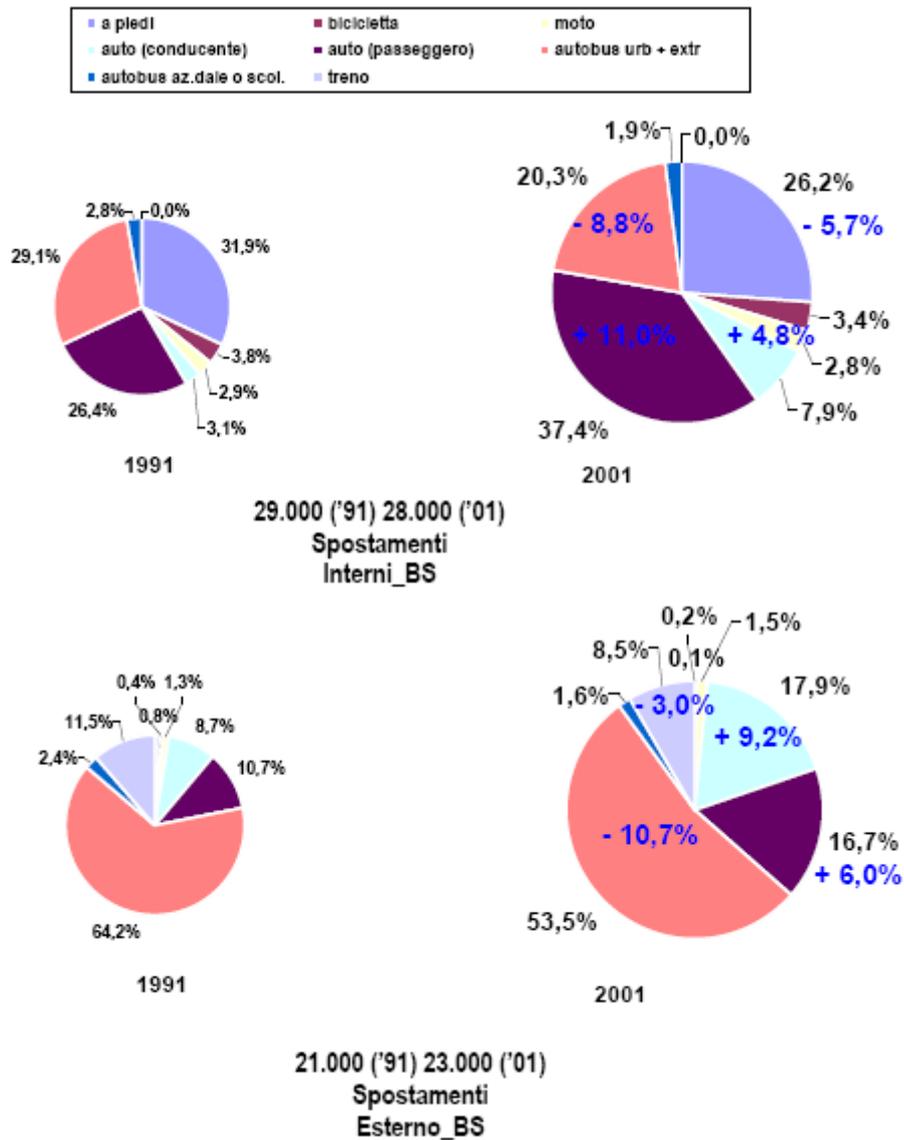


Fig.A2.2: Modal split referred to the home-school systematic movements internal and external to Brescia

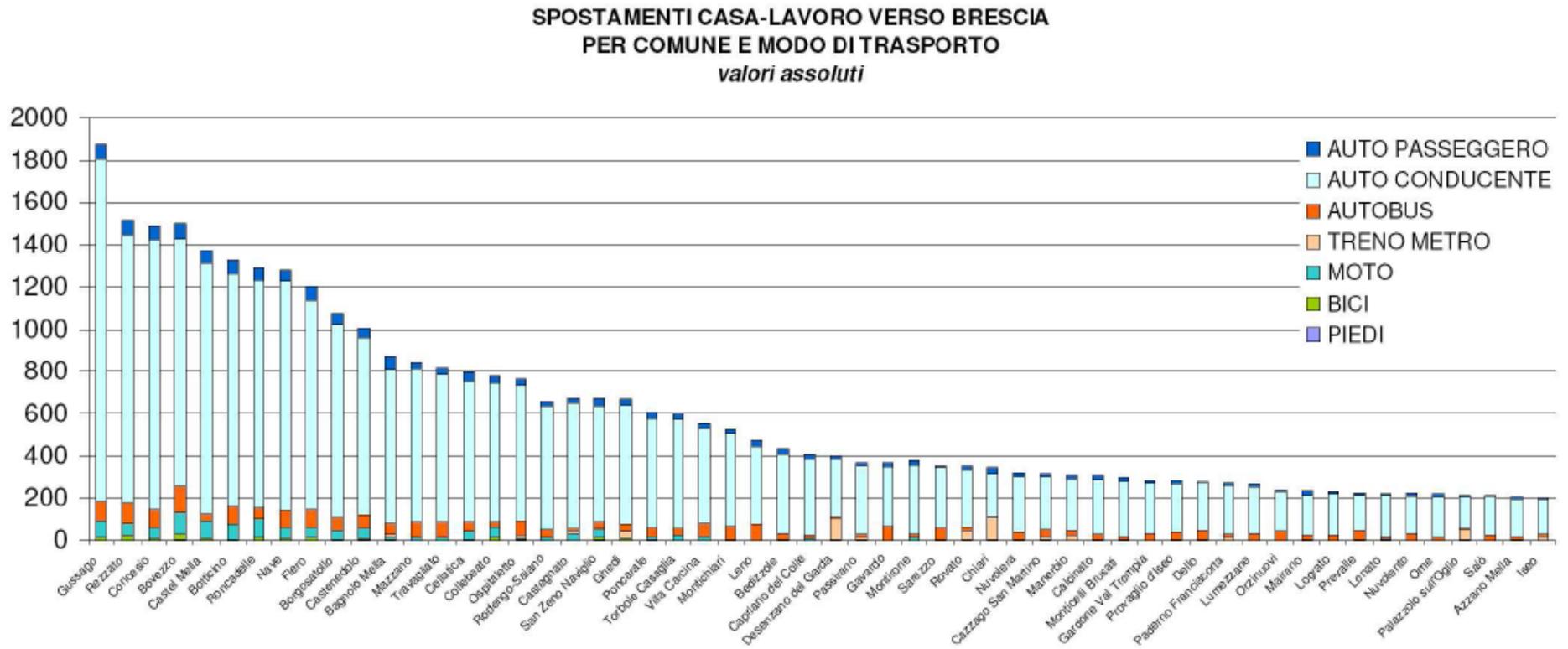


Fig.A2.3: Modal split referred to the home-work systematic movements external to Brescia by municipalities – absolute values

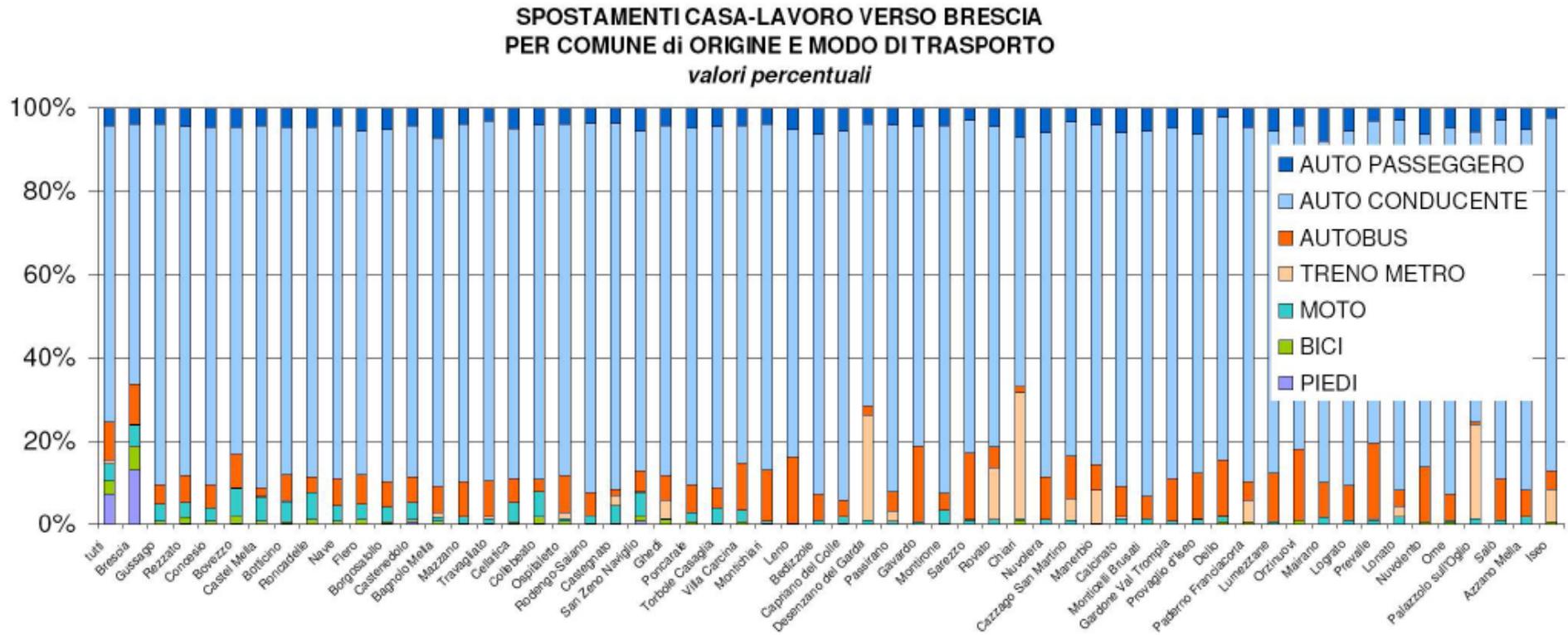


Fig.A2.4: Modal split referred to the home-work systematic movements internal and external to Brescia - percentages

Summarizing data presented above, the following average modal split has been set:

- On foot **9,9 %**
- Bicycle **2,4 %**
- PTW **3,0 %**
- Car **58,3 %**
- Bus **23,8 %**
- Train **2,6 %**

As regards data collection frequency, the same analysis will be undertaken in occasion of the next Istat census (2011). The official publication of results implies long and hard-working elaborations. Consequently we're not sure to obtain the necessary official information in time, i.e. within the end of CIVITAS, foreseen in 2012. In that case, an estimation based on the traffic flows, on PT and on Bike/Car sharing trends (Istat draft versione of the results) could be made.

- **Indicator 12 (Vehicle Occupancy)** – This indicator considers the average people on board and is collected through a specific survey among the CS users. For this indicator the Ex ante data collection is not scheduled. Anyway, the first data collection can be scheduled on June 2011, and the ex post situation can be calculate in June 2012 and it is referred to data provided by the service operator.

**AFTER SITUATION - FIRST DATA COLLECTION (JUNE 2011)**

Data to be collected for this indicator can derive both from a survey lead in internet open to everyone (on the Car Sharing dedicated web site) and newsletter sent to the subscribers. The survey was lead in June 2011 (the first newsletter was sent on 1st June and a second one on 24th June). Notwithstanding the involvement of people, only 10 of the 30 CS users (18% of the total number of subscribers) answered the questionnaire. The specific question able to monitor the vehicles occupancy is “How many people usually travel with you”? The possible answers were: I travel alone, 2 people besides me, 3 people besides me, 4 people besides me. The obtained results are the following:

Answers	%
I travel alone	0
2 people besides me	11
3 people besides me	0
4 people besides me	0
Not Answered	89
TOTAL	100

Tab.A2.34: Vehicle Occupancy

**AFTER SITUATION - FIRST DATA COLLECTION (APRIL 2012)**

Data to be collected for this indicator can derive both from a survey lead in internet open to everyone (on the Car Sharing dedicated web site). The survey was lead in April 2012, only 18 of the 287 CS users answered the questionnaire. The specific question able to monitor the vehicles occupancy is “How many people usually travel with you”? The possible answers were: I travel alone, 2 people besides me, 3 people besides me, 4 people besides me. The obtained results are the following:

Answers	%
I travel alone	16,7
2 people besides me	22,2
3 people besides me	0
4 people besides me	0
Not Answered	61,1
TOTAL	100

Tab.A2.35: Vehicle Occupancy

- Indicator 13 (Awareness Level)** – Some questions about car sharing have been inserted in the questionnaires elaborated for the measures 05.02 and 05.03. The target area is extended to the whole urban area of Brescia. The representative sample is to be chosen among the resident population. The sample size is of about 600 families, to be selected among the personal data of the Municipality (this allows a statistical significance of more than the 90%). The method used for questionnaires collection initially scheduled (in Evaluation plan) has been slightly modified: besides the face to face interviews, as the survey based on face to face interviews required more time than the scheduled, to collect a significant ex-ante before the implementation of the measure, a faster procedure that slightly differs from the initial one scheduled has been chosen: the questionnaires have been administered by phone. The sample size characteristics are the same described above. The company’s duty is to administer the questionnaires by phone, to collect them, to enter data in a database and to elaborate the results.

**EX ANTE SITUATION (March 2010)**

**Results elaboration:** To reach the goal of 600 filled in questionnaires, the company contacted 787 families. Only 220 of them answered to the phone calls but thanks to the fact that families are generally composed by more than one members, has been collected totally **601 filled in questionnaires**. The questionnaires has been administered **from 5<sup>th</sup> February to 3<sup>rd</sup> March 2010**.

<i>Do you know that in Brescia a Car Sharing service will be implemented?</i>	
NO	619 (89%)
YES	74 (11%)
TOTAL	693 (100%)

Tab.A2.36: Awareness level

**AFTER SITUATION (April 2011)**

<i>Do you know that a Car Sharing service has been implemented in Brescia?</i>	
NO	562 (89%)
YES	69 (11%)
TOTAL	631 (100%)

Tab.A2.37: Awareness level

**AFTER SITUATION (April 2012)**

<i>Do you know that a Car Sharing service has been implemented in Brescia?</i>	
NO	69 (71%)
YES	28 (29%)
TOTAL	97 (100%)

Tab.A2.38: Awareness level

- **Indicator 14 (Acceptance Level)** - see description indicator 13.

**EX ANTE SITUATION (March 2010)**

<i>According to your mobility needs, would you be interested into this service?</i>	
NO	631 (91%)
YES	62 (9%)
Total	693 (100%)

Tab.A2.39: Acceptance level

**AFTER SITUATION (April 2011)**

<i>According to your mobility needs, would you be interested into this service?</i>	
NO	549 (87%)
YES	82 (13%)
Total	631 (100%)

Tab.A2.40: Acceptance level

**AFTER SITUATION** (April 2012)

<i>According to your mobility needs, would you be interested into this service?</i>	
NO	554 (84%)
YES	103 (16%)
Total	657 (100%)

Tab.A2.41: Acceptance level

## Annex 3: Cost Benefit Analysis

### Evaluation period for CBA

- Defining reference case for CBA

CBA has been carried out comparing the hypothetical situation without the car sharing service (reference case or Business-as-Usual scenario) with the effective present situation, including the implementation of the Car Sharing Civitas Measure (Car Sharing scenario).

- Defining lifetime of the measure

The reference year is 2010, in which a private Company, charged by the Municipality of Brescia, implements and manages the car sharing service inside the town. The whole period, taken into consideration by CBA to have a financing return, is 15 years (final CBA year: 2025).

- Discount rate

The average yearly interest rate estimated in the 15 years period of CBA (2010-2025) is 3,5%.

### Method and values for modification

The Measure (introduction of the car sharing service), using last generation new cars with lower consumptions/emissions, allows to reduce fuel and pollution than old private cars assumed to be used in the B.A.U. scenario. Fuel reduction has been included in the economic benefits as operating cost saving at collective level, because it contributes towards the “expenses reduction” of imported goods from foreign countries.

From the carried out monitoring activity, the total kms run with car sharing measure are 16.022 km (year 2010) and 44.142 (year 2011). The yearly increasing rate of the kms run by car sharing service should equal 28,8%, in order to re-pay the investment costs (Municipality financing) in 15 years (NPV at 2025>0). Adopting this yearly increase, the total kms run by car sharing in 15 years should be 1.526.420 kms.

- Description of how the impacts are monetised

Fuel saving revenues: the average fuel consumption, referred to a car with medium cubic capacity that runs in urban network, is estimated 11 km/l; the fuel cost adopted by CBA is 0,6 € (economic cost excluding taxes and referred to year 2010).

#### Emissions costs:

The emission quantities of the main environmental polluting agents are shown in Table 2.6.2.a for the different car types with medium cubic capacity (runs in urban network): grams/km of carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM) and carbon dioxide (CO2).

EMISSION FACTOR	GASOLINE CAR				GASOIL CAR				CAR SHARING (average)
	EURO1	EURO2	EURO3	EURO4	EURO1	EURO2	EURO3	EURO4	
CO emission factor (g/km)	10,52	8,52	8,96	3,90	1,00	0,37	0,26	0,19	0,10
NOx emission factor (g/km)	0,59	0,31	0,21	0,11	1,21	0,87	0,76	0,44	0,08
PM emission factor (g/km)	-	-	-	-	0,13	0,09	0,05	0,03	-
CO2 emission factor (g/km)	385,90	385,90	385,90	347,30	276,50	276,50	276,50	248,90	165,00

Tab.A3.1: Polluting emission factors of the different car types (source: Euro normative)

The percentage of the different car types usually running in Brescia town in 2010 without car sharing service is shown in the following Table 2.6.2.b:

GASOLINE CAR				GASOIL CAR			
EURO1	EURO2	EURO3	EURO4	EURO1	EURO2	EURO3	EURO4
4%	17%	12%	21%	1%	6%	16%	23%

Tab.A3.2: Car distribution in Brescia province in 2010 (source: ACI)

The money return of the environmental benefits has been carried out basing on EU data; in particular the figures (total external costs in urban zone) referred to the main polluting agents (CO, NOx, PM and CO2) taken into consideration in the CBA, are shown in Table A3.3.c and are referred to €2010.

EMISSION TYPE	ESTERNAL COST (€2010/kg)
CO emission (*)	0,004
NOx emission (**)	3,755
PM emission (**)	434,164
CO2 emission (**)	0,110

Tab.A3.3: Money return of the main polluting agents (€2010/Kg)

Source: (\*) Astra – Scenario Low External Cost - 2005

(\*\*) HEATCO, D5 Proposal for harmonised Guidelines – Brussels, 2006

- References of values used
  - ACI statistics (2010)
  - Astra – Scenario Low External Cost - 2005
  - HEATCO, D5 Proposal for harmonised Guidelines – Brussels, 2006

**Life time cost and benefit**

	Cases for comparison	Cost (e.g. €200,000)
Year 0 (2010)	Car Sharing measure	€ 60,000
	Reference case (or BAU)	-
Year 1 (2011)	Car Sharing measure	€ 70,000
	Reference case (or BAU)	-
Year 2 (2012)	Car Sharing measure	€ 64,000
	Reference case (or BAU)	-

Tab.A3.4: Capital cost in the evaluation period (not discounted)

	Cases for comparison	Values (e.g. €200,000)
Year 0	Car Sharing measure	€ 643
	Reference case (or BAU)	€ 877
Year 1	Car Sharing measure	€ 1,772
	Reference case (or BAU)	€ 2,416
Year 2	Car Sharing measure	€ 2,282
	Reference case (or BAU)	€ 3,112
Year 3	Car Sharing measure	€ 2,939
	Reference case (or BAU)	€ 4,008
Year 4	Car Sharing measure	€ 3,785
	Reference case (or BAU)	€ 5,162
Year 5	Car Sharing measure	€ 4,876
	Reference case (or BAU)	€ 6,648
Year 6	Car Sharing measure	€ 6,280
	Reference case (or BAU)	€ 8,563
Year 7	Car Sharing measure	€ 8,088
	Reference case (or BAU)	€ 11,029
Year 8	Car Sharing measure	€ 10,418
	Reference case (or BAU)	€ 14,206
Year 9	Car Sharing measure	€ 13,418
	Reference case (or BAU)	€ 18,297
Year 10	Car Sharing measure	€ 17,282

	Reference case (or BAU)	€ 23,567
Year 11	Car Sharing measure	€ 22,260
	Reference case (or BAU)	€ 30,354
Year 12	Car Sharing measure	€ 28,670
	Reference case (or BAU)	€ 39,096
Year 13	Car Sharing measure	€ 36,927
	Reference case (or BAU)	€ 50,355
Year 14	Car Sharing measure	€ 47,562
	Reference case (or BAU)	€ 64,858
Year 15	Car Sharing measure	€ 61,260
	Reference case (or BAU)	€ 83,537

Tab.A3.5: Operation cost/savings from fuel reductions in the evaluation period (not discounted)

	Cases for comparison	Values (e.g. €200,000)
Year 0	Car Sharing measure	€ 297
	Reference case (or BAU)	€ 734
Year 1	Car Sharing measure	€ 817
	Reference case (or BAU)	€ 2,021
Year 2	Car Sharing measure	€ 1,053
	Reference case (or BAU)	€ 2,603
Year 3	Car Sharing measure	€ 1,356
	Reference case (or BAU)	€ 3,353
Year 4	Car Sharing measure	€ 1,747
	Reference case (or BAU)	€ 4,318
Year 5	Car Sharing measure	€ 2,250
	Reference case (or BAU)	€ 5,562
Year 6	Car Sharing measure	€ 2,898
	Reference case (or BAU)	€ 7,164
Year 7	Car Sharing measure	€ 3,732
	Reference case (or BAU)	€ 9,227
Year 8	Car Sharing measure	€ 4,807
	Reference case (or BAU)	€ 11,885
Year 9	Car Sharing measure	€ 6,191

	Reference case (or BAU)	€ 15,308
Year 10	Car Sharing measure	€ 7,974
	Reference case (or BAU)	€ 19,716
Year 11	Car Sharing measure	€ 10,271
	Reference case (or BAU)	€ 25,395
Year 12	Car Sharing measure	€ 13,229
	Reference case (or BAU)	€ 32,708
Year 13	Car Sharing measure	€ 17,039
	Reference case (or BAU)	€ 42,128
Year 14	Car Sharing measure	€ 21,946
	Reference case (or BAU)	€ 54,261
Year 15	Car Sharing measure	€ 28,266
	Reference case (or BAU)	€ 69,889

Tab.A3.6: Savings from reductions of environmental emissions (not discounted)

Measure title: Mobility Management Actions in Brescia

City: Brescia

Project: Modern

Measure number: 06.05

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
<b>Reference Measure - Business as Usual: traditional transport without car sharing service implementation</b>																
Investment costs	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel costs	877	2.416	3.112	4.008	5.162	6.648	8.563	11.029	14.206	18.297	23.567	30.354	39.096	50.355	64.858	83.537
Emissions costs	734	2.021	2.603	3.353	4.318	5.562	7.164	9.227	11.885	15.308	19.716	25.395	32.708	42.128	54.261	69.889
<b>Civitas Measure: with implementation of car sharing service</b>																
Investment costs (1)	60.000	70.000	64.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel costs	643	1.772	2.282	2.939	3.785	4.876	6.280	8.088	10.418	13.418	17.282	22.260	28.670	36.927	47.562	61.260
Emissions costs	297	817	1.053	1.356	1.747	2.250	2.898	3.732	4.807	6.191	7.974	10.271	13.229	17.039	21.946	28.266
<b>Civitas Measure vs Reference Measure</b>																
Investment costs (1)	- 60.000	- 70.000	- 64.000	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel saving revenues (2)	234	644	830	1.069	1.376	1.773	2.284	2.941	3.788	4.879	6.284	8.094	10.426	13.428	17.295	22.276
Emissions cost saving (3)	437	1.204	1.550	1.997	2.572	3.313	4.267	5.495	7.078	9.117	11.742	15.124	19.479	25.090	32.315	41.622
TOTAL	- 59.329	- 68.152	- 61.620	3.066	3.948	5.085	6.550	8.437	10.866	13.996	18.027	23.218	29.905	38.518	49.611	63.899
OVERALL TOTAL	- 59.329	- 127.481	- 189.101	- 186.036	- 182.088	- 177.002	- 170.452	- 162.015	- 151.149	- 137.153	- 119.127	- 95.909	- 66.003	- 27.486	22.125	86.024
TOTAL BENEFIT	671	1.848	2.380	3.066	3.948	5.085	6.550	8.437	10.866	13.996	18.027	23.218	29.905	38.518	49.611	63.899
TOTAL COST	60.000	70.000	64.000	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>INTEREST RATE</b>	3,5%															
<b>NET PRESENT VALUE</b>	- 57.323	- 120.944	- 176.521	- 173.850	- 170.526	- 166.389	- 161.240	- 154.833	- 146.860	- 136.939	- 124.591	- 109.226	- 90.105	- 66.309	- 36.697	154
<b>BENEFITS/COSTS RATIO</b>	0,01	0,02	0,03	0,04	0,06	0,09	0,12	0,16	0,22	0,29	0,39	0,51	0,66	0,86	1,11	1,44
<b>I.R.R.</b>												-8,7%	-4,9%	-1,7%	1,1%	3,5%

NOTES:

(1) Financing support by Brescia Municipality for car sharing implementation

(2) Fuel saving due to the lower consumption of the new cars used by car sharing service than old private cars used in B.a.U. (without car sharing service)

(3) Emissions saving due to new cars used by car sharing service than old private cars used in B.a.U. (without car sharing service)

Tab.A3.7: Lifetime cost/benefit of the reference measure/case and car sharing civitas measure (discounted)

## Summary of CBA results

Table 2.6.5 shows the main results of CBA (net present value, benefits/costs ratio, investment rate return), referred to year 2025 (CBA period: 15 years).

<b>COST/BENEFIT ANALYSIS</b>	<b>2025</b>
TOTAL KM RUNNING (km)	1.526.420
INTEREST RATE	3,5%
NET PRESENT VALUE (€ 2010)	154
BENEFITS/COSTS RATIO	1,44
I.R.R.	3,5%

Tab.A3.8: CBA results between Car Sharing Civitas Measure and Reference Measure/BaU (year 2025)

The investment cost by Brescia Municipality (194,000 €) to support the car sharing civitas measure is re-paid in 15 years, thanks emission and fuel saving, only if the total kms running by car sharing service are 1,526,420 kms.

This means that, the car sharing service, with the low starting (2010 and 2011 monitorings: 16,022 kms and 44,142 kms), should increase yearly in the next 15 years of 28,8%, in order to can monitor 1,526,420 kms at 2025 and reach the cumulative value of 6,673,219 kms in 15 years (2010-2025).

In fact, only with this use increasing, the Net Present Value and the Benefit/Costs Ratio become respectively up zero and up one in 15 years.

The Investment Return Rate at 2025 results 3,5%, practically equal to the estimated Interest Rate (3,5%).

## **M07.02 – Executive summary**

Brescia is a medium sized city (about 190'000 inhabitants) characterized by a valuable historical centre and a wide metropolitan area.

When CIVITAS started, the main topics related to city logistic and freight distribution organisation under discussion in Brescia were:

- *the logistic pole localization (Urban Distribution Centre)*: since from a planning point of view the logistic pole localization should serve both the metropolitan and the urban areas;
- *the new organisation of freight distribution in the historical centre*: the access to the city centre was managed through a Limited Traffic Zone (LTZ) – residents, Local Public Transports (buses and taxi) and several authorized people could enter it. The LTZ was characterized by different time bands (Z1 -the core- with no access 24 hours a day; Z2, with open access from 4 pm to 8 am) to allow the freight distribution in the city centre where about 500 commercial activities are located.

Thanks to this measure a Urban Logistics Plan has been elaborated for analysing the “state of art” of freight distribution in Europe and in some Italian cities, proposing solutions for Urban Distribution Centre location and several management actions in order to reorganize freight distribution in the city. In particular, for the historical centre new time windows and restriction have been foreseen. Pedestrianisation of main historical squares – with a substantial reorganisation of freight movement – has been carried out to reach a high environmental quality in the heart of the city.

In order to monitor the measure outputs, during its implementation, information on weighting factor and number of accesses to the historic centre has been collected. The data helped to understand if the operators rationalized their deliveries, by optimizing the use of their vehicles capacity and reducing their accesses to the historical city centre. As a measure outcome, the number of delivery vans decreased by 18%, trucks by 14.5% and articulated lorries by 2.5%.; while the weighting factor increased by 12%.

These results were related to the restricted time windows and to the pedestrianization, both implemented step by step, in the city centre by the Municipality. The transport companies had to reduce the journeys for the deliveries to respect the time restrictions to enter the centre and they had to increase the weighting factor, exploiting more the vehicles at their disposal, to satisfy the traders deliveries. The reduction and the reorganization of load/unload slot influenced the choice of vehicles used and the weighting factor.

In addition, by the data collected through the LTZ cameras, it was remarked that the pedestrianization and the restrictive measures also contributed to the reduction of the private cars accesses (- 9,2%).

Concerning the stakeholder acceptance of the distribution centre, it has been assessed through a survey spread among the most important commercial operators in Brescia (15 companies). The results proved that during Civitas operators had a constant interest in the distribution centre development.

## A. Introduction

### A1 Objectives

The measure objectives are:

(KK) High level / longer term:

- To improve the quality of life of the citizens reducing freight movement in particular in the city centre;
- To improve conditions in relation to pollution due to delivery of freights.

(LL) Strategic level:

- To regulate the freight urban distribution (according to town planning policies) increasing the weighting factor and reducing pollutant freight means of transport trough the reduction of delivery time and using new sustainable means of transport.

(MM) Measure level:

- (1) To define the Logistical Urban Plan;
- (2) To introduce restrictive measures in order to optimise weighting factor in the city centre, as a first step for the future actuation of the Logistical Urban Plan contents (the measure aims to increase by 60% of the weighting factor and to reduce by 20% of the commercial traffic flow in the rush hour);

### A2 Description

Brescia is a medium sized city (about 190.000 inhabitants) characterized by a valuable historical centre and a wide metropolitan area.

Since mid eighties a discussion on city logistic and freight distribution organisation has been carried out among politicians without finding an agreement that could lead to a solution to be implemented, the main topics under discussion were:

- *the logistic pole localization (Urban Distribution Centre)*; from a planning point of view the logistic pole localization should have had to serve both the metropolitan and the urban areas, this led to a wider number of stakeholders involved in localization choice with subsequent problems.

The delay in taking such decision was no longer acceptable for the city of Brescia; therefore an Urban Logistics Plan was elaborated during Civitas. It contains the analysis of the "state of art" in Europe and in some Italian cities. During Civitas the case of Brescia was analysed and the project proposal led to the feasibility study for Brescia urban distribution centre.

- *the new organisation of freight distribution in the historical centre*; the access to the city centre is managed trough a Limited Traffic Zone (LTZ) –residents, Local Public Transports (buses and taxi) and several authorized people can enter it. As a matter of fact only few pedestrian area are available, with a general low quality of the environment.

The LTZs were divided into two zones characterized by different time bands to allow the freight distribution in the city centre where about 500 commercial activities are located.

- Z1 -the core- with no access 24 on 24 hours;

- Z2, with open access from 4 pm to 8 am.

The historical city centre of Brescia is going to be renewed because the new metro line (start up foreseen by 2013) allows to stop busses from running through it and also the pedestrianization of the main historical squares in the city. In order to reach a high quality of the historical urban environment a reorganisation of freight distribution time window and of freight itself is absolutely necessary.

During Civitas a more rational urban freight distribution was introduced to optimize the weighting factor of deliveries through pedestrianization and restrictions in several parts of the historical centre. As a matter of fact new rules as specific time windows to enter the city centre, new weight limits and new delivery spots were introduced together with the progressive pedestrianization (figure 1) of Paolo VI Square, Corso Mameli and Loggia Square (first step), continuing with Corso Zanardelli and Via X Giornate (after the conclusion of the works for the underground, second step).

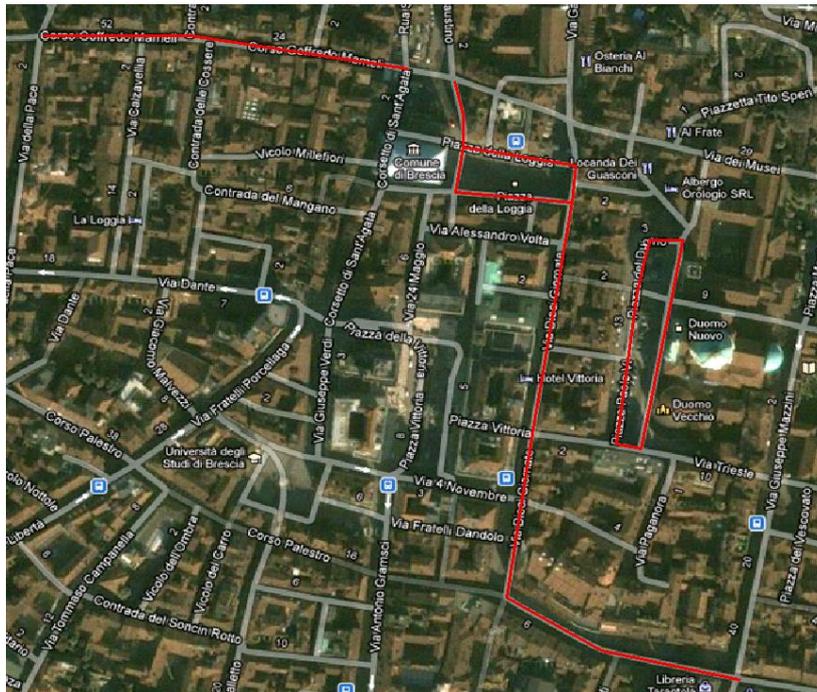


Fig.1: Pedestrianization project in the city centre of Brescia

The restrictive measure and the pedestrianization can be considered as preparatory steps for a general reorganisation of the freight distribution together with the freight distribution centre that will start next November.

## B. Measure implementation

### B1 Innovative aspects

- New conceptual approach
- Targeting specific user groups
- New policy instrument.

The innovative aspects of the measure are:

- **Innovative aspect 1 (New conceptual approach)** – The rearrangement of the urban freight distribution is an important challenge for a city and must be planned not only through the adoption of local policies (such as the Urban Logistic Plan), but it has to be faced also at a territorial level (Province and Region). This is the reason why the involvement of several stakeholders was crucial for the design and the implementation of the local policies regarding the freight distribution.
- **Innovative aspect 2 (Targeting specific user groups)** – One of the tangible outputs of the measure consisted in the approval of restrictive measures (through a municipal decree) addressed to the freight distribution organization in the historical city centre. The freight distribution operators regularly loaded/unloaded their freight in the city centre and the restriction consisted in changing the opening/closing time for the access to the historic centre. Therefore a targeted group of stakeholders was involved by the Municipality to increase awareness and acceptance about the Municipality choices regarding freight distribution and to discuss the future urban freight distribution pole.
- **Innovative aspect 3 (New policy instrument)** – The freight traffic in urban areas was about the 25% of the total circulating vehicles. A more effective system, based on a rational distribution/packing waste gathering management could contribute to the improvement of the general quality of life in the city centre (also in terms of air pollution, traffic congestion and noise pollution). This was one of the main topics developed in the Logistical Urban Plan that was developed before the adoption of time restrictive measures. For Brescia, this approach was innovative, as it gave a systemic vision of the urban freight movements in the city.

### B2 Research and Technology Development

Research activities mainly regarded the elaboration of the Urban Logistic Plan, that consisted in

- ✓ survey about urban freight distribution (benchmarking on the European and Italian state of the art);
- ✓ specific surveys about Brescia, including traffic flow analysis, updating of the O/D matrix for the city centre, analysis of weighting factors, etc., survey about the main commercial operators and the delivery area in LTZ;
- ✓ project proposal of the best position for the location of the Urban Distribution Centre (UDC). The UDC organisation concerned: main functions, relations between storage and delivery, management and technological architecture;
- ✓ monitoring, marketing, financial plan (break even point), expected outcomes/social benefits.

The above mentioned survey was made by Interporto (an external society) that put a series of questions to the most important freight distribution companies in Brescia. Through these collected

information (related, for example, to the historic centre accesses, the time bands to enter the historic centre, the used vehicles, the weighting factor), it was possible to have data to develop the restrictive measures.

The study on the Urban Distribution Centre was focused on accessibility problems in relation to the existing mobility infrastructures - kind of traffic flow was analysed together with road geometry and design - . Among the suitable areas in the west side of the city, near the highway (exit “ Brescia Ovest”) the Ex-Ortomercato Area was chosen, as some existing buildings could be rented for the UDC. The new UDC will start by November 2012.

### **B3 Situation before CIVITAS**

Brescia is a medium sized city characterized by a metropolitan area and an historical centre that dates back to the Roman times.

The access to the city centre is regulated with Limited Traffic Zone (LTZ) with a restricted access to residents, LPT busses, taxis and delivery services. For the latter it is divided into two zones (see the figure 2) characterized by different time bands to enter the historic centre:

- Z1 -the core- with no access 24 on 24 hours,
- Z2, with open access from 4 pm to 8 am.



Fig.2: Limited traffic zone (LTZ) in historic centre of Brescia: Z1 were the yellow coloured areas, Z2 the blue ones.

The freight distribution system running downtown in Brescia was based on the autonomous delivery of the goods carried out by private couriers. Within the city centre, several load/unload parking zones were dedicated to the couriers and the only limitation consisted in specific time bands, regulated by the LTZ cameras. Thanks to the participation to the Civitas Project, it was possible to undertake in-depth studies of a re-organization of the freight distribution, towards more efficient management schemes based also on a future logistic pole (Urban Distribution Centre)..

The issue of freight movements was developed involving stakeholders, in particular for the city centre couriers and the shopkeepers. The reorganization of downtown freight distribution was carried out during pedestrianisation of the main squares of the city (Piazza del Duomo and Piazza della Loggia). Both actions reorganization of downtown freight distribution and the pedestrianisation of the main squares are related to requalification of the historical city centre. The former foresees a better environment and the changing of the time bands, restrictions and reorganization of freight parking slots and can be considered preparatory for the future Urban Distribution Centre start up; the latter is related to the start up of the metrobus by 2013 that will allow the removal of several buses from the city centre.

## B4 Actual implementation of the measure

The measure was implemented in the following stages:

**Stage 1: Elaboration of the Urban Logistic Plan** (from October 2008 to November 2010) – The Plan consisted in in-depth analysis of the phenomenon of freight distribution and in economic feasibility studies of the solution proposed for Brescia, that was the realization of an Urban Freight Distribution Centre (which worked as shown in figure 2 reported below).

*In particular, the investigated aspects were the following:*

- *analysis of the weighting factor;*
- *review of major traders;*
- *localization of load/unload areas for freights in the historic centre (ZTL);*
- *project proposal, including also the definition and the possible localization of the Urban Freight Distribution Centre.*

*The main goal of this closer examination was to outline the state of art of the freight movements in Europe and in some Italian cities also to find out the best solution for the delivery/collection of goods in terms of efficiency (reducing altogether external/internal costs of the management of the logistic services), punctuality and precision through a new project proposal.*



Fig.3: Urban Freight Distribution Centre system

*Feasibility study of the Urban freight distribution foresaw:*

- *a survey about delivery areas in LTZ;*
- *analysis of the commercial vehicles traffic flows in the city centre (LTZ) to evaluate the impact of freight movement;*
- *benchmarking analysis: best practices in Italy and in Europe (Vicenza, Padova, Ferrara, Genova, Siena, Brema, Basilea, Utrecht, Zurich, etc...), also identifying critical situations and best practices in city logistic and restrictive measures implementation. The introduction of restrictive measures leads to advantages in terms of pollution reduction, traffic reductions and increase in weighting factor.*
- *preliminary design and location of the UDC (urban distribution centre)*
- *in-depth studies about the scheme of the main functions of UDC,*
- *the relationship between storage and delivery functions of UDC;*
- *proposals for UDC management, considering also the necessary technological development.*

*The reorganisation of the freight distribution in the historical centre of Brescia- foreseen in the Logistical Urban Plan developed during Civitas - has provided the possibility for the couriers, to deliver their goods to a logistic platform close to the city centre.*

*The distribution of the goods from the freight distribution centre to the commercial activities in the city centre will be carried out using low-environmental impacts vehicles.*

*The UDC technological development has foreseen an operative management platform equipped with GPS devices for the fleet control and for the real time load tracking and tracing.*

*The UDC can be potentially exploited also for other activities,, such as shopkeepers' home deliveries and the "reverse logistic" (gathering of the package waste).*

**Stage 2: Preparation of the restrictive measures** (from March 2010 to March 2011) – *The elaboration of the Municipal Decree, that introduced the new restrictive measures for urban freight distribution in the city centre was carried out from spring 2011 taking into consideration the information deriving from the Urban Logistic Plan.*

*In particular time bands and accessibility to several places were changed. The restrictive measures mentioned above regarded private cars and the freight distribution vehicles. The Decree did not concern freight distribution fleet.*

**Stage 3: Operational launch of the measure and system running** (from April 2011 to October 2012) – During this stage, the Municipal Decree was officially approved. Dissemination campaign in order to inform citizens about the restrictive measures were carried out. After that date the restrictions were in force and regulated by the LTZ control cameras. This decree integrated the activities related to the restrictive measures with the pedestrianization of the city centre of Brescia.

The topic of reorganization of freight distribution was publicly discussed during an organized round table “Non motorized mobility and historic centres: the case of Brescia”(during the XVIII International Conference “Living and walking in cities - Sustainable mobility and road safety” on the 17th June 2011).

Pedestrianization actions were implemented in phases.

For example Paolo VI Square (i.e Piazza del Duomo) was pedestrianised starting in April 2011.

The first phase concerned in the elimination of parking spaces in the central and south side of the square ,in flower pots introduction, in bollards with automatic system to restrict the access only to selected users, in goods delivery spot definition (specifically 5 delivery stalls in the north side and 1 in the south side).

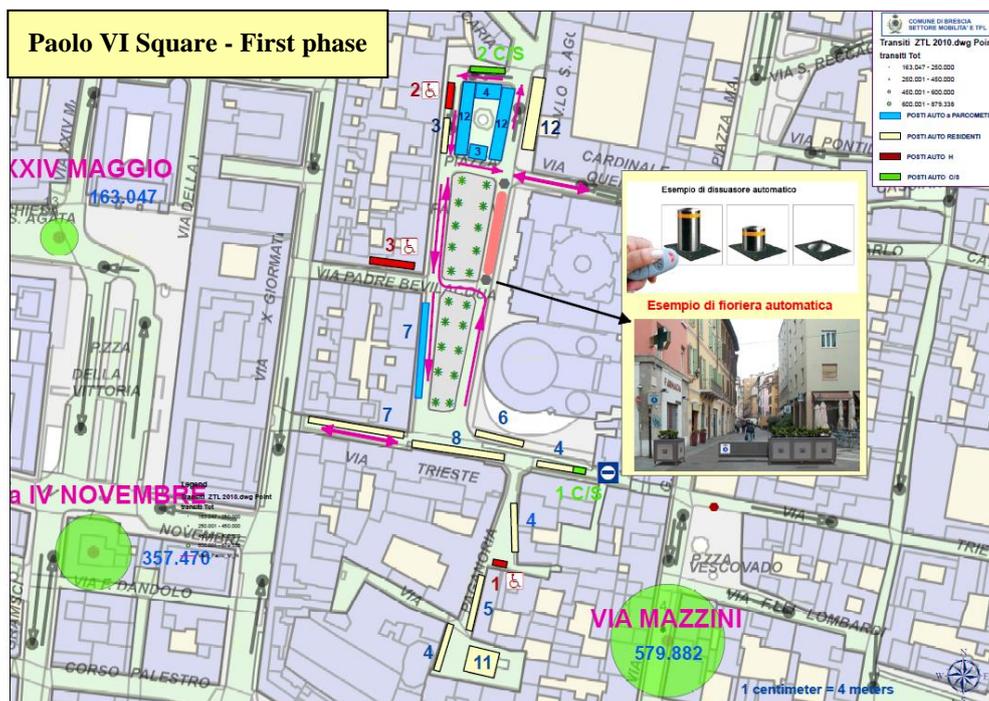


Fig.3: First phase of the restrictive measures implementation in Paolo VI Square

The second phase (see fig.4 reported below) - July 2011 - regarded the central and southern part of the square:

- 7 parking places were removed.
- 7 freight parking slots were located between via X Giornate and Paolo VI Square (close to via Trieste) and they were monitored till November 2011, to understand the interferences with pedestrians traffic flows.
- 3 parking spaces reserved to disabled people were introduced in via Bevilacqua (northern area) by reducing parking meter slots.
- access to the Dome and to the theatre was allowed during events.

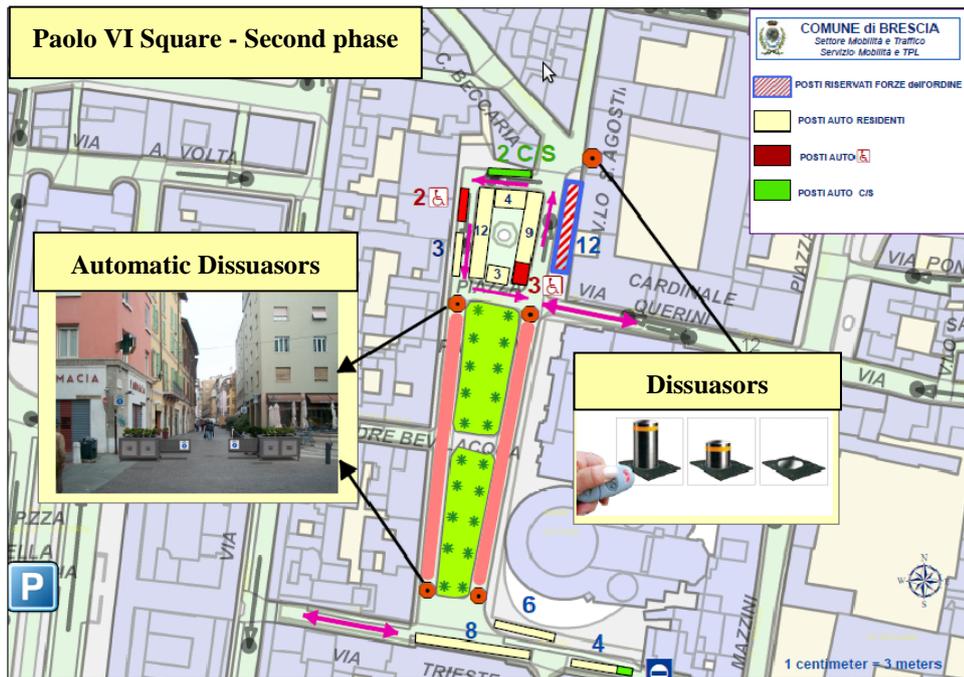


Fig.4: Second phase of the restrictive measures implementation in Paolo VI Square

The third phase (see figure 4) was carried out during Summer 2012 (in coincidence with the opening of the first floor of the parking lot of Victoria Square) and regarded:

- the introduction of a no parking zone in the Northern side of the square ,
- 12 parking slots reserved to the police set in the East side of the square near the Broletto
- implementation of new restriction in time bands for commercial vehicles.
- 5 delivery spots (were maintained) allowing goods distribution from 6:00 am to 10:30 am.

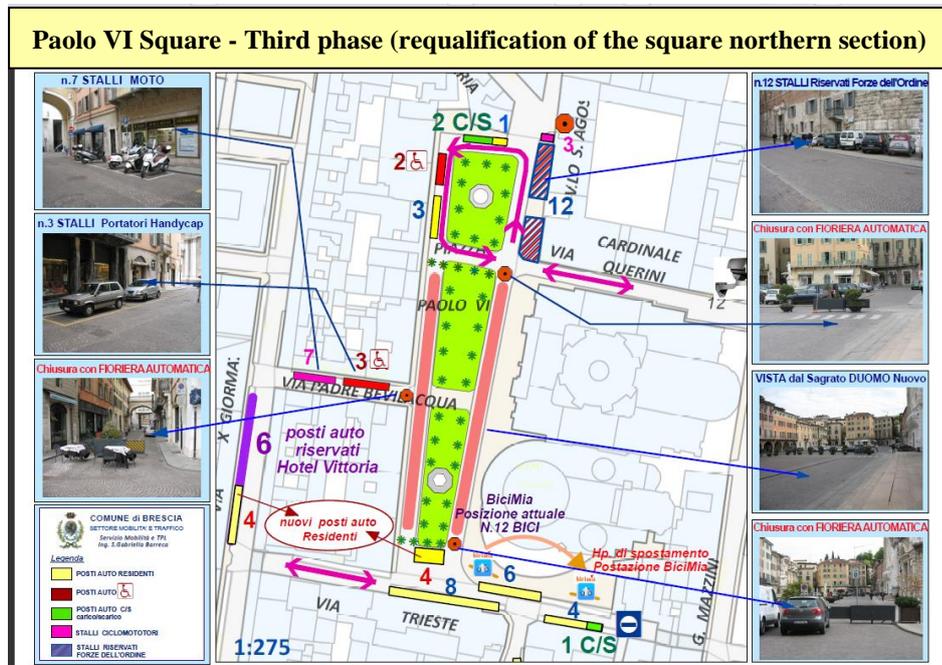


Fig.5: Third phase of the restrictive measures implementation in Paolo VI Square

*Pedestrianisation also involved Corso Mameli (fig.6 reported below), from in Spring 2012 to July 2012. Corso Mameli is located between via Pace and Vicolo Paitone and the intervention on this street regarded:*

- use of existing PILOMAT near the Pallata Tower to restrict vehicles transit,
- setting of flower pots to control the access to Corso Mameli, Calzavellia street and Contrada Delle Cossere (residents were allowed in via Calzavellia, Contrada delle Cossere, Vicolo San Pietro Martire)
- incentives (such as a discount up to the 50% of the costs of the public ground occupation) were offered to the traders in the area
- 1 freight load/unload slot was allowed in the west side (via Pace)
- 5 freight load/unload slots were allowed in the east side (Largo Formentone)
- restriction of the time bands for freight deliveries ,to 6.30 – 10.00 am. (instead of previous 6.30 – 11.30 am ; 13.30 – 18.30 pm).



*Fig.6: Pedestrianization and restrictive measures implementation in Corso Mameli*

*Piazza della Loggia pedestrianization was carried out into two steps starting from April 2011  
The first step foresaw:*

- restrictions for the LTZ 0-24 (just residents bus and taxi)
- two new LTZ virtual gate, one in Largo Formentone, one in Corsetto Sant'Agata.
- new time bands for the suppliers accesses
- “no access” zones to Piazza Loggia for the commercial vehicles, a u-turn was allowed for commercial vehicles
- new delivery area located in Largo Formentone.
- new time band in Piazza Loggia and Corsetto Sant'Agata to 6.30 – 10.15 am. (instead of previous 6.30 – 11.30 am ; 13.30 – 18.30 pm).



Fig.7: Pedestrianization and restrictive measures implementation in Loggia Square

The second step foresaw (figure 8):

- no busses and taxis in Piazza della Loggia ( from 8.00 p.m – to 04:00 a.m.), leaving the square completely free and accessible only to pedestrians and bicycles.



Fig.8: Final result of the restrictions introduced in Loggia Square

In mid October 2012 a new Municipality Decree - concerning Corso Zanardelli (transit of 350.000 vehicles a year) - to be carried out at the beginning of November was approved .

The restrictive measures, took into account both the needs of the residents and the traders and regard:

- delivery areas at the borders of Corso Zanardelli
- 2 freight distribution slots on the West side (via X Giornate)
- 3 freight distribution slots on the East side (via Mazzini/via San Martino della Battaglia crossroad).
- restriction of area to buses, taxis, police and disabled.
- time band to load/unload from 6.30 a.m. to 10.00 a.m. and compulsory exit within 10.15 a.m. (instead of previous 6:30 a.m. to 11:30 a.m., 1:30 p.m. to 6:30 p.m.).

*In order to reduce parking demand in the historical centre free parking during the weekend (Friday to Sunday, from 7.00 p.m. to 2.00 a.m.) was provided in parking structures in Vittoria Square and Fossa Bagni (1 € from 6 p.m. to 8 a.m).*

*In order to improve the public awareness about these discounts of weekend parking rates, a communication campaign was carried out. At the same a free shuttle bus from Fossa Bagni parking to the city centre was introduced. .*

*New rules were also applied for goods delivery: the existing time bands were reduced to a single one 6.30 a.m – 10.00 a.m.*

## **B5 Inter-relationships with other measures**

The measure isn't significantly related to other measures.

## C. Evaluation – methodology and results

From the evaluation point of view, the main impact of the measure consisted in the implementation of access restrictions - defined in the Logistical Urban Plan - that led to optimising weighting factor in the historical city centre,

This monitoring action is useful also in the view of the future freight distribution centre, which will manage the freight distribution in the historic centre.

At the beginning of the Civitas project, the measure was considered a focused one, because it foresaw the purchase of a selected, non pollutant fleet for freight distribution in the city centre.

Therefore, at the time, it was considered necessary to collect data on "Economy" (Average Operating Revenues and Costs) and also to built up a Cost Benefit Analysis (CBA). In addition, also environmental impacts of the purchased fleet would have been collected. It's important to highlight that, during the actual measure implementation, vehicles have not been purchased and the measure is not considered anymore as a focused one. Therefore, the CBA wasn't arranged and all the data related to the categories "Economy" and "Environment" weren't collected.

### C1 Measurement methodology

#### C1.1 Impacts and Indicators

**Table C1.1: Indicators.**

No.	Impact	Indicator	Data used	Comments
1	Economy: Operating Revenues	Average Operating Revenues	Data from CBA	<b>NO MORE COLLECTED</b>
2	Economy: Operating Costs	Average Operating Costs	Data from CBA	<b>NO MORE COLLECTED</b>
3	Environment: Emissions	Emissions according to the typology of fleet selected and purchased	Environmental monitor stations data crossed with the commercial vehicles access in the city centre	<b>NO MORE COLLECTED</b>
4	Transport: transport system	Freight Movement	The indicator expresses the amount of commercial vehicles circulating in the historic city centre detected by LTZ cameras	Main Indicator First data collection after the OP: May 2011
5	Transport: transport system	Weighting factor (quest)	Data declared by the freight delivery operators in the feasibility study survey of the freight distribution centre	Main Indicator First data collection after the OP: April 2012
6	Society: Acceptance	Stakeholders	Data declared by the freight delivery	Main Indicator First data collection

		Acceptance (quest)	operators in the feasibility study survey of the freight distribution centre	after the OP: april 2012
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Detailed description of the indicator methodologies:

- **Indicator 1 (AVERAGE OPERATING REVENUES)** – Ratio of total income generated from fares divided by the weighting factor.- NO MORE COLLECTED
- **Indicator 2 (AVERAGE OPERATING COSTS)** – Ratio of total operating costs incurred by the fleet divided by the weighting factor.- NO MORE COLLECTED
- **Indicator 3 (EMISSIONS ACCORDING TO THE TYPOLOGY OF FLEET SELECTED)** – This indicator is defined as the average of several emission (CO<sub>2</sub>, CO, NO<sub>x</sub> and Small particulate) per vehicles/km by vehicle and fuel types of the fleet.- NO MORE COLLECTED
- **Indicator 4 (FREIGHT MOVEMENT)** – total number of commercial/industrial vehicles moving in the demo area (Brescia city centre). This indicator can be calculated considering the commercial vehicle passages recorded by LTZ cameras during a standard week. The vehicles detected by these cameras are delivery vans, trucks or articulated lorries.
- **Indicator 5 (WEIGHTING FACTOR)** – Data come from a survey made among the most important commercial operators that deliver freights in Brescia (15 companies). They have been asked to provide specific information used to calculate this indicator: the average weight of the deliveries in the historic centre and the type of vehicle used for the freight distribution in the city centre itself . The ratio between these values give the weighting factor.
- **Indicator 6 (STAKEHOLDERS ACCEPTANCE)** – Data come from a survey made among the most important commercial operators that deliver freights in Brescia (15 companies). This indicator is expressed by the ratio between the number of operators interested in a potential urban freight distribution centre and the total number of interviewed operators.

## C1.2 Establishing a Baseline

From the evaluation point of view, the main objective of the measure consisted in introducing restrictive measures (since spring 2011), as defined in the Urban Logistics Plan, in order to optimise weighting factor of goods distribution and to reduce the vehicles access to the historic centre. The realization of the urban freight distribution centre to manage the freight distribution in the historic centre of the city wasn't foreseen within the end of Civitas project.

The selected indicators were able to evaluate the actions concerning the freight distribution reorganization in the city centre, (restrictive Municipality of Brescia Decree - time window for the freight delivery downtown and pedestrianization actions).

The operational phase consisted in the issue of the Decree in Spring 2011, therefore the baseline was set as year 2010, when the ex ante data collection was done, the indicators values are shown in the table below.

Indicators	BASELINE (2010)		
	Kind of vehicle	Average weekly accesses to Brescia city centre	%
4) Freight Movement	Passenger Cars	12290,2	84%
	Delivery Vans	983,8	7%
	Trucks	235	2%
	Autobus	899,8	6%
	articulated lorries	276,6	2%
	Total Vehicles	14685,4	100%
	5) Weighting factor	0,0016	
6) Stakeholders Acceptance	11/15 = 73,3%		

*Tab.1: Baseline of the measure selected indicators*

### C1.3 Building the Business-as-Usual scenario

The BaU scenario of the measure was built basing on several qualitative assumptions. As a matter of fact, without the Civitas project contribution, probably the restrictive measures and the in-depth study carried out during the measure implementation wouldn't have been developed. Therefore the BaU scenario for the selected indicators was considered equal to the Baseline values.

Indicators	BaU (2012)		
	Kind of vehicle	Average weekly accesses to Brescia city centre	%
4) Freight Movement	Passenger cars	12290,2	84%
	Delivery vans	983,8	7%
	trucks	235	2%
	Autobus	899,8	6%
	articulated lorries	276,6	2%
	Total vehicles	14685,4	100%
	5) Weighting factor	0,0016	
6) Stakeholders Acceptance	11/15 = 73,3%		

*Tab.2: BaU of the measure selected indicators*

### C2 Measure results

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

## C2.4 Transport

**Table C2.3.1: Results obtained for the Indicators corresponding to area “Transport”**

Indicator	Before (April 2010)			After data collection			B-a-U			Difference: After –Before		Difference: After – B-a-U													
4) Freight Movem ent	Type of vehicle	Average weekly accesses to Brescia city centre	% of total vehicles	May 2011			May 2011			Type of vehicle	Average weekly accesses to Brescia city centre	Type of vehicle	Average weekly accesses to Brescia city centre												
		Delivery vans		983,8	7%	Type of vehicle	Averag e weekly accesses to Bresci a city centre	% of total vehicles	Type of vehicle					Average weekly accesses to Brescia city centre	% of total vehicl es	Type of vehicle	Average weekly accesses to Brescia city centre								
		trucks		235	2%													Delivery vans	1225	7%	trucks	983,8	7%	trucks	+241
		articulate d lorries		276,6	2%													trucks	239	1,3%	trucks	235	2%	articulated lorries	+4
																		articulate d lorries	275	1,5%	articulate d lorries	276,6	2%	articulated lorries	-1,6
																		April 2012			April 2012			Type of vehicle	
				Type of vehicle	Averag e weekly accesses to Bresci a city centre					% of total vehicles	Type of vehicle	Average weekly accesses to Brescia city centre	% of total vehicl es					Type of vehicle	Average weekly accesses to Brescia city centre	Type of vehicle	Average weekly accesses to Brescia city centre				
				Delivery vans	805,8	6,00%	Delivery vans	983,8	7%	Delivery vans	-178	Delivery vans	-178												
				trucks	200,8	0,15%	trucks	235	2%	trucks	-34,2	trucks	-34,2												
				articulate d lorries	269,5	2,05%	articulate d lorries	276,6	2%	articulated lorries	-7,1	articulated lorries	-7,1												

Indicator	Before (April 2010)	After data collection	B-a-U	Difference: After –Before	Difference: After – B-a-U
5) Weighting factor	0,0016	April 2012: 0,0018	April 2012: 0,0016	+0,0002	+0,0002

The commercial vehicles accesses were recorded by LTZ cameras during a standard week, in order to monitor the actual effectiveness of the restrictive measures implementation in the historic centre of Brescia.

Thanks to the data collection, a considerable reduction of vehicles was made evident (indicator n.4): delivery vans decreased by 18%, trucks by 14,5% and articulated lorries by 2,5%.

The weighting factor (indicator 5) increased by 12% from the ex ante to the after data collection. These results were related to the restricted time bands and to the pedestrianization, both implemented step by step, in the city centre by the Municipality. As a matter of fact, the transport companies had to reduce the journeys for the deliveries to respect the time restrictions to enter the centre and they had to increase the weighting factor, exploiting more the vehicles at their disposal, to satisfy the traders deliveries. The reduction and the reorganization of load/unload slot influenced the choice of vehicles used and the weighting factor.

In addition, by the data collected through the LTZ cameras, it was remarked that the pedestrianization and the restrictive measures also contributed to the reduction of the private cars accesses (- 9,2%).

## C2.5 Society

**Table C2.4.1: Results obtained for the Indicators corresponding to area “Society”**

Indicator	Before (April 2010)	After data collection	B-a-U	Difference: After –Before	Difference: After – B-a-U
6) Stakeholders Acceptance	11/15 = 73,3%	April 2012: 73,3%	April 2012: 73,3%	0%	0%

Stakeholder acceptance of the distribution centre, was carried out through a survey arranged among the most important commercial operators in Brescia (15 companies).

The results proved that during the Civitas project operators had a constant interest in the distribution centre development.. Besides the implemented “restrictive measures in the historical centre” concerning didn’t negatively influence the general interest in the City logistic..

**C3 Achievement of quantifiable targets and objectives**

No.	Target	Rating
1	<p>Define the Logistical Urban Plan</p> <p><i>The objective can be considered achieved in full.</i></p> <p><i>As a matter of fact, the Logistical Urban Plan was arranged in July 2011 and the restrictive measures were the first step for the future actuation of the Logistical Urban Plan.</i></p>	**
2	<p>Introduction of restrictive measures in order to optimise weighting factor in the city centre</p> <p><i>The objective achievement was evaluated by three specific issues:</i></p> <p><i>1) Introduction of restrictive measures;</i>  <i>The pedestrianization of some historic centre streets and squares and the restrictive measures for the freight distribution were implemented.</i></p> <p><i>2) Optimization of the weighting factor, increased by 60%</i>  <i>To monitor the weighting factor indicator n. 5 (weighting factor) was considered:</i>  <i>Ind. 5 (weighting factor)</i>  <i>Year 2010 (Before) = 0,0016</i>  <i>Year 2011 (After) = 0,0018</i>  <i>The increase of the weighting factor was about 12%.</i></p> <p><i>2) Reduction of the commercial traffic flows by 20%</i>  <i>To monitor the commercial vehicles accesses in the historic centre, indicator n. 4 (freight movement) was considered; From the data collection, reduction of delivery vans by 18%, trucks by 14,5% and articulated lorries by 2,5%.</i></p>	<p>**</p> <p>O</p> <p>*</p>
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full            *** = Exceeded</b></p>		

## **C4 Up-scaling of results**

The freight distribution restrictions are already applied to the whole Limited Traffic Zone, the up scaling of the measure could only consist in the enlargement of the managed deliveries beyond the historic centre borders.

The proposed up scaling of the measure would potentially decrease the commercial vehicles traffic flows in Brescia increase the weighting factor and stimulate the use of the new freight distribution centre (start up by December 2012).

## **C5 Appraisal of evaluation approach**

The evaluation approach was based on project's objectives as expressed explicitly in the original evaluation plan The data collection methodology and the data quality can be considered sufficient for the needs of the technical evaluation of the measure.

The indicators selected at the beginning of Civitas project were divided in four different categories: Economy, Environment, Transport and Society. During the development of the measure several indicators were deleted in relation to the downgrade of the measure from "focused" to "soft" one.

Indicators from the following categories were no more collected:

- "Economy"
- "Environment".

As regards the "Transport" category the indicators n.4 "freight movement", n. 5 "weighting factor" were set in order to evaluate the impact of the restrictive measures on the freight distribution in the historical centre.

As regards the "Society" category indicator n. 6 "stakeholders acceptance" was introduced to measure the acceptance level of the operators in the development of an urban freight distribution centre.

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – during Civitas project, the elaboration of the Logistical Urban Plan was carried out and it was considered a strong effort of Brescia Municipality, because it was the first action addressed to the rationalization and management of the freight movement in the city.. The investigated aspects were the load factor, the review of major traders, the localization of load/unload areas in the historic centre (LTZ) and the project proposal for the urban freight distribution centre, including also the definition and the possible localization of the centre itself.
- **Key result 2** – the introduction of restrictive measures was an important step for the Logistical Urban Plan implementation. As a matter of fact, the effectiveness of these activities was evaluated also through the weighting factor trend control, which increased more than 10% (from 0,0016, as ex ante data collection, to 0,0018, as ex post data collection) after the restrictive measures implementation.
- **Key result 3** – The pedestrianization project was another important result obtained also through the traffic flow control with the time bands restriction. This is also a first step in the historical city centre renewal As a matter of fact the city centre is composed by Roman and Medieval squares and streets (Paolo VI Square, Loggia Square, Corso Zanardelli, Via X Giornate, Corso Mameli), which represent the core of the city.

## **C7 Future activities relating to the measure**

The start up of the Urban Distribution Centre is foreseen by December 2012.

Measure title: **FREIGHT DISTRIBUTION IN BRESCIA**

City: **Brescia**

Project: **MODERN**

Measure number: **07.02**

Info updated after the final submission of the MERT in November 2012 and already reported in the Annex A of the measure (POINTER revision received on January 2013):

An experimental form of UDC (Urban Distribution Centre) was activated on November 12<sup>th</sup> 2012 and is currently operating. The experimental UDC offers the possibility to use 3 clean vehicles to access the city centre without restriction: this could influence the behaviour of all the freight operators, favouring the introduction of electric vehicles to take advantage of a wider time slots to deliver in LTZs.

## **D. Process Evaluation Findings**

### **D.0 Focused measure**

This measure was at first a focused one, but, considering the measure development, it was downgraded (see Annex A, October 2011).

### **D1 Deviations from the original plan**

The Urban Distribution Centre wasn't started during Civitas and the new freight distribution fleet wasn't set up therefore the impact of the measure mainly regarded the restriction of the accesses to the historical centre - new time bands for freight and pedestrianization.

### **D2 Barriers and drivers**

#### **D2.1 Barriers**

##### **Preparation phase**

- **Institutional barrier** – Long new bureaucratic procedures, introduced in year 2010, were met by ML during approval of the “restrictive” Decree by the City Council of Brescia, The delay was linked also to the necessity of political consensus by shopkeepers on the city centre reorganization.

##### **Implementation phase**

- **Cultural barrier** – Some difficulties were met as regards the operators' awareness and agreement about the restrictive measure implementation in the historic centre. As a matter of fact, the resistance in accepting the foreseen restrictive measure addressed also to the commercial vehicles for the freight distribution, was shown most of all by transport operators and dealers. On the contrary, the citizens mostly agreed with the pedestrianization of the city centre.

##### **Operational phase**

- **Problem related barrier** – a lack of shared sense of urgency among key stakeholders (freight operators and shopkeeper) was met during the implementation of the restrictive measures.

#### **D2.2 Drivers**

##### **Preparation phase**

- **Institutional driver** –The new metro line - start up by 2013 -, that allows the pedestrianisation of main squares and of several streets in the historical city centre.

##### **Implementation phase**

- **Cultural driver** - thanks to this measure implementation, the introduction of different ways to manage freight distribution in the city centre was possible; as a matter of fact a new cultural and life style was introduced in Brescia.

## **D2.3 Activities**

### **Preparation phase**

- **"State of art" studies** – the first important step consisted in the necessary in-depth studies concerning other cities (in Italy and Europe), that had rationalized and managed the urban freight distribution in the historic centre.
- **Preliminary stakeholders involvement** – key stakeholders were involved to discuss the freight distribution problems to be solved, to spread information about different viewpoints and to draw up informal agreements. In addition, it was necessary to explain the pressure of the freight distribution management problems and to share the sense of urgency among key stakeholders to reach a rational urban freight distribution in Brescia.

### **Implementation phase**

- **Plan and analyze users needs** – An accurate technical and economic planning and analysis were carried out to determine requirements of user needs. It was important highlight that the involvement of Province of Brescia, FFSS Logistica and the Municipality of Brescia contributed to stimulate the interest to the urban freight distribution.

### **Operational phase**

- **Implementation "step by step"** - pedestrianization restrictive measures addressed also to the freight distribution rationalization were implemented in the historic centre in several steps, to better monitor the effect of each one and also to create and increase awareness and acceptance among different stakeholders of the on going changing of the freight movement in the city centre.

## **D3 Participation**

### **D.3.1 Measure partners**

Only in relation to the City Logistic study, the partners of the measure were:

- **Brescia Mobilità SpA** - the Brescia Mobility Agency who manages all the current mobility services;
- **Brescia Mercati SpA** - a public company who hosts the logistic platform at Ortomercato;
- **Lombardia Region** - who supported the Brescia city logistics scheme;
- **CityPorto Padova** - the city logistic company who provided technical support to the service startup in terms of technology implementation and fare definition.

### **D.3.2 Stakeholders**

- **Interporto** - it was the external society, which carried out the first survey among the commercial operators, potentially involved in the freight distribution management.
- **Transport operators** - they were involved due to the restrictive measures implementation and the reorganization of the delivery areas in the historic centre. Furthermore, they were involved in the feasibility in-depth studies about the freight distribution centre in Brescia.

- **Shopkeepers** - they were involved both in the pedestrianization and in the restrictive measure, as the deliveries addressed to them were influenced by these changes.
- **Citizen of Brescia and in particular of the historic centre** - They were involved most of all in the pedestrianization and in changing of the accesses to these areas.

#### **D.4.1 Recommendations: measure replication**

- **Follow progressive steps of implementation** - No specific methodology has been assessed to carry out the developed work, having applied consolidated methodologies to carry out the design and dimensioning work; most of the work performed on the UDC has been derived from the experience of the UDC operating in Padova. The results of the measure are represented by particular applications related to the specific interested area and situations, so that any transferability can only be methodological. In this sense it is recommended to tackle the urban freight distribution issue following progressive steps of implementation. The measure is successful not only if the time slots to access LTZs are modified, but also if the fleet composition is affected, by recurring, for example, to economic incentives for the fleet renewal or by offering an urban freight distribution service (such as UDC) able to give an alternative to deliver freights in the city centre.

#### **D.4.2 Recommendations: process**

- **Recommendation 1** - it's important to create a strong willingness of the Municipality in order to overcome the NIMBY attitude towards changing the existing state.
- **Recommendation 2** - the involvement of all stakeholders (shopkeepers, commercial operators and citizens) is considered fundamental to point out their needs as regards the access to the city centre, also in order to follow better lines of action in the freight distribution planning in the historic centre.
- **Recommendation 3** - an in-depth study about the realization of the freight distribution centre and its management (freight distribution entity, management costs, building costs, etc.) is considered fundamental. As a matter of fact, this information is important not only for the Municipality, but also for the transport operators, which usually have to pay this kind of service.
- **Recommendation 4** - the official commitment among Province of Brescia, FFSS Logistica and Municipality of Brescia was necessary to reach the goal to implement restrictive measures, sharing information and design of the restrictive measures to be implemented in the historic centre.

## Annex 1: Historical data series for the BaU calculation

- Indicator 4 - (FREIGHT MOVEMENT)

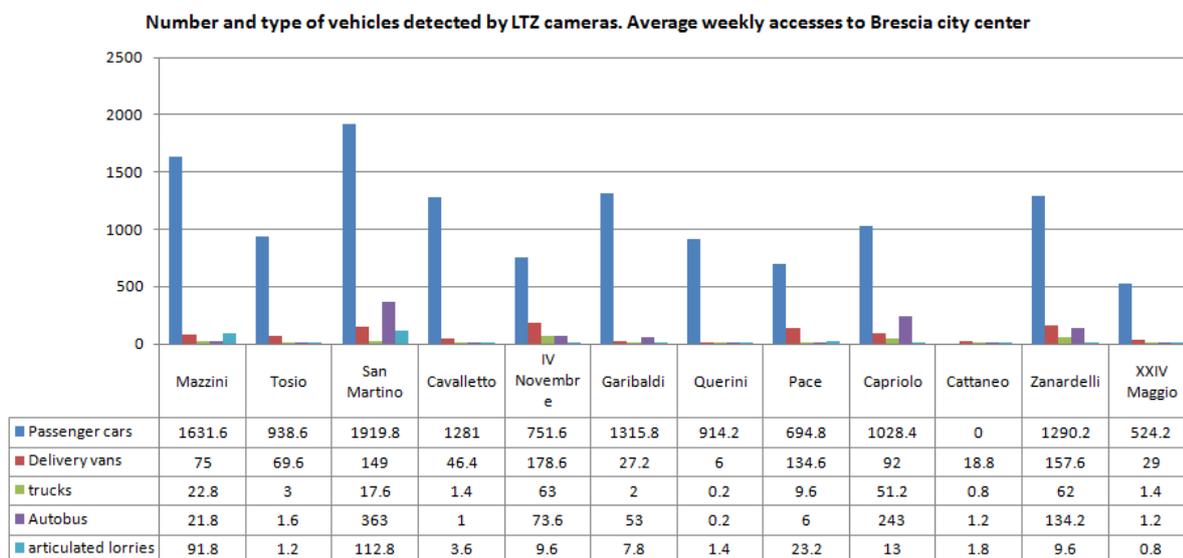


Fig.A1.1: Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

	Average weekly accesses to Brescia city centre	%
Passenger cars	12290,2	84%
Delivery vans	983,8	7%
trucks	235	2%
Autobus	899,8	6%
articulated lorries	276,6	2%
Total vehicles	14685,4	100%

Tab.A1.1: Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

- Indicator 5 (WEIGHTING FACTOR):** the table below shows the average weight per daily delivery in the city centre, as it has been declared by the operators.

**CALCOLO TONNELLATE MERCE GIORNALMENTE  
IN ENTRATA NEL COMUNE DI BRESCIA**

Operatori intervistati	Nr consegne giornaliere	Peso medio/consegna Kg	Peso totale consegne Kg	Peso totale kg Consegne per citylogistics
Messaggerie del Garda	5	150	750	750
MIN	55	50	2750	2750
GLS - General Logistics Systems Italy S.p.A.	90	10	900	900
J.M Trasporti srl	4	120	480	
Tardini	1	10	10	10
SITTAM srl	1	100	100	100
Arco Spedizioni spa	30	150	4500	4500
FERCAM spa	8	100	800	
Antoni Trasporti spa	10	5	50	50
Autotrasporti Giudici	1	5	5	5
Simoni Trasporti	6	100	600	600
Sifte Berti spa	5	30	150	150
Omnia 2007	1	10	10	10
Speed Monti srl	20	10	200	200
Bartolini Corriere Espresso	200	5	1000	
<b>TOTALE</b>	<b>437</b>		<b>12.305</b>	<b>10.925</b>

Fig.A1.2: Results of the first survey carried out among transport operators.

The average weight per delivery (basing on the single weight declared by the operators) is 57 kg/delivery.

Considering that the most common vehicle used for the deliveries in the city centre can transport up to 35'000 kg (source: "Urban Logistic Plan" page 60), the weighting factor can be estimated dividing the average weight per delivery by the maximum weight that a commercial vehicle is able to carry.

Therefore,  $ind. 5 = 57 \text{ kg} / 35'000 \text{ kg} = 0,0016$

- **Indicator 6 (STAKEHOLDERS ACCEPTANCE)** – Interviewed people have been asked to answer to a specific question: "Are you interested in a future citylogistic initiative?"  
The following table shows the results of the survey and the answers to the question:

## CALCOLO NUMERO DI CONSEGNE

Operatori intervistati	Eventuale adesione a iniziativa Citylogistics	Frequenza consegne in ZTL	N. consegne	Da intervistati	Da operatori potenziali aderenti Cityporto
Messaggerie del Garda	Sì	Giornaliera	5	5	5
MTN	Sì	Giornaliera	55	55	55
GLS - General Logistics Systems Italy S.p.A.	Sì	Giornaliera	90	90	90
3 M Trasporti srl	Indecisa	Giornaliera	3/4	4	
Tardini	Sì	Settimanale	5	1	1
SITTAM srl	no	Settimanale	2	1	
Arco Spedizioni spa	Sì	Giornaliera	30	30	30
PERCAM spa	no	Giornaliera	8	8	
Artoni Trasporti spa	Sì	Giornaliera	10	10	10
Autotrasporti Giudici	Sì	Bisettimanale	1	1	1
Simoni Trasporti	Sì	Giornaliera	6	6	6
Sifte Berti spa	Sì	Giornaliera	5	5	5
Omnia 2007	Sì	Mensile	2	1	1
Speed Monti srl	Sì	Giornaliera	20	20	20
Bartolini Corriere Espresso	no	Giornaliera	180/200	200	
<b>TOTALE</b>				<b>437</b>	<b>225</b>

Fig.A1.3: Results of the first survey carried out among transport operators.

The table above shows that 11 operators on 15 would be interested in a citylogistic initiative in Brescia, therefore:

Indicator n.6 =  $11/15 = 73,3\%$

## Annex 2: Ex ante and Ex Post data collection

- **Indicators 1 and 2** (Average Operating Revenues and Costs) :This measure should be a focus measure (object of a CBA), because of the restrictive measures adopted only in timing for freight distribution in the city centre without any restriction on the fleet used, neither the urban freight distribution centre will be realized in Civitas, the measure downgraded as soft won't foresee collection of the economic indicators.

### NO MORE COLLECTED

- **Indicator 3** (Emissions according to the typology of fleet selected) - This measure should be a focus measure (object of a CBA), because of the restrictive measures adopted only in timing for freight distribution in the city centre without any restriction on the fleet used to access the historic centre.

### NO MORE COLLECTED

- **Indicator 4** (Freight Movement) This indicator can be calculated considering the commercial vehicle passages recorded by LTZ cameras during a standard week. The vehicles detected by these cameras are delivery vans, trucks or articulated lorries.

### EX ANTE DATA COLLECTION:

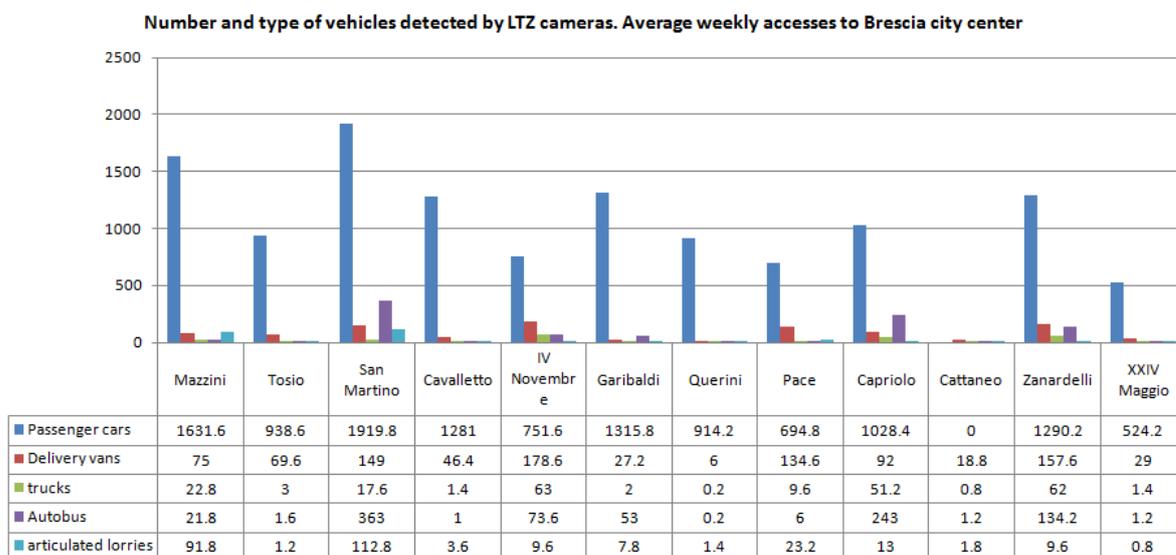


Fig.A2.1. Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

	Average weekly accesses to Brescia city centre	%
Passenger cars	12290,2	84%
Delivery vans	983,8	7%
trucks	235	2%
Autobus	899,8	6%
articulated lorries	276,6	2%
Total vehicles	14685,4	100%

Tab.A2.1. Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

**EX POST DATA COLLECTION (May 2011):**

Type of vehicle	Average weekly accesses to Brescia city centre	%
Passenger cars	15128	85%
Delivery vans	1225	7%
trucks	239	1,3%
Autobus	906	5,2%
articulated lorries	275	1,5%
Total vehicles	17773	100%

Tab.A2.2. Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

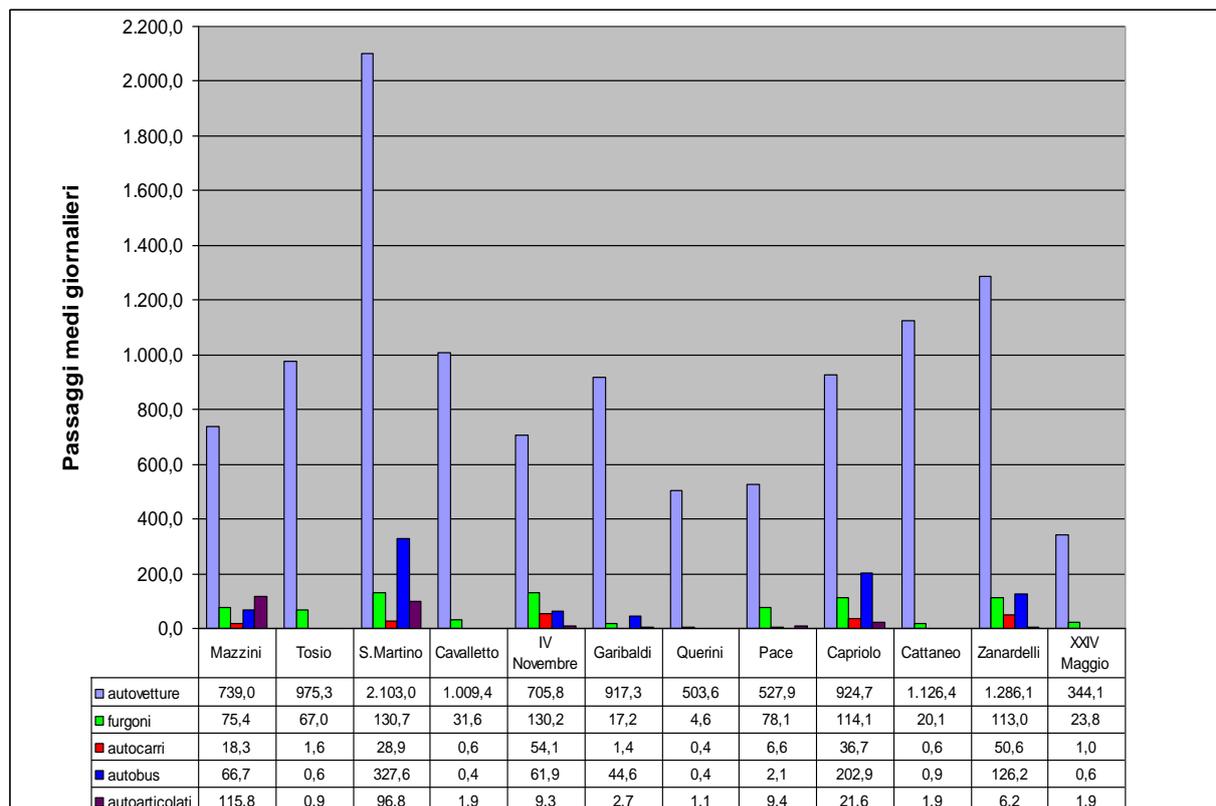
**EX POST DATA COLLECTION (April 2012):**

Fig.A2.2. Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

	Average weekly accesses to Brescia city centre	%
Passenger cars	11162,6	84,10%
Delivery vans	805,8	6,00%
trucks	200,8	0,15%

Autobus	834,9	6,01%
articulated lorries	269,5	2,05%
Total vehicles	13273,6	100,00%

Tab.A2.3. Number of vehicles entering the Brescia city centre detected by LTZ cameras by type.

- **Indicator 5** (Weighting factor): This indicator has been calculated using data coming from the feasibility study "Urban Logistic Plan". Data come from a survey made among the most important commercial operators that deliver freights in Brescia (15). They have been asked to provide some specific information, as for example the average number of daily deliveries, and the average weight of the freights delivered in the city centre.

**EX ANTE SITUATION (2010)**

The table below shows the average weight per daily delivery in the city centre, as it has been declared by the operators .

<b>CALCOLO TONNELLATE MERCE GIORNALMENTE IN ENTRATA NEL COMUNE DI BRESCIA</b>				
Operatori intervistati	Nr consegne giornaliere	Peso medio/consegna Kg	Peso totale consegne Kg	Peso totale kg Consegne per citylogistics
Messaggerie del Garda	5	150	750	750
MIN	55	50	2750	2750
GLS - General Logistics Systems Italy S.p.A.	90	10	900	900
J.M Trasporti srl	4	120	480	
Tardini	1	10	10	10
SITTAM srl	1	100	100	100
Arco Spedizioni spa	30	150	4500	4500
FERCAM spa	8	100	800	
Antoni Trasporti spa	10	5	50	50
Autotrasporti Giudici	1	5	5	5
Simoni Trasporti	6	100	600	600
Sifte Berti spa	5	30	150	150
Omnia 2007	1	10	10	10
Speed Monti srl	20	10	200	200
Bartolini Corriere Espresso	200	5	1000	
<b>TOTALE</b>	<b>437</b>		<b>12.505</b>	<b>10.025</b>

Tab.A2.4: Results of the first survey carried out among transport operators.

The average weight per delivery (basing on the single weight declared by the operators) is 57 kg/delivery.

Considering that the most common vehicle used for the deliveries in the city centre can transport up to 35'000 kg (source: "Urban Logistic Plan" page 60), the weighting factor can be estimated dividing the average weight per delivery by the maximum weight that a commercial vehicle is able to carry.

Therefore, ind. 5 = 57 kg / 35'000 kg = 0,0016

**EX POST DATA COLLECTION (April 2012):**

**CALCOLO TONNELLATE MERCE GIORNALMENTE  
IN ENTRATA NEL COMUNE DI BRESCIA**

Operatori intervistati	Nr consegne giornaliere	Peso medio/consegna Kg	(%) carico del mezzo	Portata mezzo consegne	Peso totale consegne Kg	Peso totale kg Consegne per citylogistics
Messaggerie del Garda	5	160	80%	35 q.li	800	800
MTN	60	60	85%	35 q.li	3600	3600
GLS - General Logistics Systems Italy S.p.A.	90	15	90%	35 q.li	1350	1350
3 M Trasporti srl	5	130	80%	35 q.li	650	
Tardini	1	12	75%	35 q.li	12	12
SITTAM srl	1	110	70%	35 q.li	110	110
Arco Spedizioni spa	30	155	75%	Max 15 q.li	4650	4650
FERCAM spa	8	120	75%	35 q.li	960	
Artoni Trasporti spa	10	8	90%	35 q.li	80	80
Autotrasporti Giudici	1	7	80%	12 tonn.	7	7
Simoni Trasporti	6	120	85%	35 q.li	720	720
Sifte Berti spa	5	35	75%	35 q.li	175	175
Omnia 2007	2	20	70%	35 q.li	20	20
Speed Monti srl	25	15	75%	35 q.li	375	375
Bartolini Corriere Espresso	200	5	90%	35 q.li	1000	

Tab.A2.5: Results of the second survey carried out among transport operators.

The average weight per delivery (basing on the single weight declared by the operators) is 64,8 kg/delivery.

Considering that the most common vehicle used for the deliveries in the city centre can transport up to 35'000 kg, the weighting factor can be estimated dividing the average weight per delivery by the maximum weight that a commercial vehicle is able to carry.

Therefore, ind. 5 =  $64,8 \text{ kg} / 35'000 \text{ kg} = 0,0018$

- **Indicator 6** (Stakeholders Acceptance) – In order to obtain this indicator, data coming from the same survey described for the indicator n.5 have been used. Interviewed people have been asked to answer to a specific question: “Are you interested in a future citylogistic initiative?”

The following table shows the results of the survey and the answers to the question:

**EX ANTE DATA COLLECTION:**

## CALCOLO NUMERO DI CONSEGNE

Operatori intervistati	Eventuale adesione a iniziativa Citylogistics	Frequenza consegne in ZTL	N. consegne	Da intervistati	Da operatori potenziali aderenti Cityporto
Messaggerie del Garda	Si	Giornaliera	5	5	5
MTN	Si	Giornaliera	55	55	55
GLS - General Logistics Systems Italy S.p.A.	Si	Giornaliera	90	90	90
3 M Trasporti srl	Indecisa	Giornaliera	3/4	4	
Tardini	Si	Settimanale	5	1	1
SITTAM srl	no	Settimanale	2	1	
Arco Spedizioni spa	Si	Giornaliera	30	30	30
FERCAM spa	no	Giornaliera	8	8	
Artani Trasporti spa	Si	Giornaliera	10	10	10
Autotrasporti Giudici	Si	Bisettimanale	1	1	1
Simoni Trasporti	Si	Giornaliera	6	6	6
Silte Berti spa	Si	Giornaliera	5	5	5
Omnia 2007	Si	Mensile	2	1	1
Speed Monti srl	Si	Giornaliera	20	20	20
Bartolini Corriere Espresso	no	Giornaliera	100/200	200	
<b>TOTALE</b>				<b>437</b>	<b>225</b>

Tab.A2.7: Results of the first survey carried out among transport operators.

The table above shows that 11 operators on 15 would be interested in a city logistic initiative in Brescia, therefore:

Indicator n.6 =  $11/15 = 73,3\%$

**EX POST DATA COLLECTION (April 2012)**

The table below shows that 11 operators on 15 would be interested in a citylogistic initiative in Brescia, therefore:

Indicator n.6 =  $11/15 = 73,3\%$

## CALCOLO NUMERO DI CONSEGNE

Operatori intervistati	Eventuale adesione a iniziativa Citylogistics	Frequenza consegne in ZTL	N. consegne	Da intervistati	Da operatori potenziali aderenti Cityporto
<b>Messaggerie del Garda</b>	Sì	Giornaliera	5	5	5
<b>MTN</b>	Sì	Giornaliera	60	60	60
<b>GLS - General Logistics Systems Italy S.p.A.</b>	Sì	Giornaliera	90	90	90
<b>3 M Trasporti srl</b>	Indecisa	Giornaliera	5	5	
<b>Tardini</b>	Sì	Settimanale	6	1	1
<b>SITTAM srl</b>	no	Settimanale	2	1	
<b>Arco Spedizioni spa</b>	Sì	Giornaliera	30	30	30
<b>FERCAM spa</b>	no	Giornaliera	8	8	
<b>Artoni Trasporti spa</b>	Sì	Giornaliera	10	10	10
<b>Autotrasporti Giudici</b>	Sì	Bisettimanale	1	1	1
<b>Simoni Trasporti</b>	Sì	Giornaliera	6	6	6
<b>Sifte Berti spa</b>	Sì	Giornaliera	5	5	5
<b>Omnia 2007</b>	Sì	Mensile	2	2	2
<b>Speed Monti srl</b>	Sì	Giornaliera	25	25	25
<b>Bartolini Corriere Espresso</b>	no	Giornaliera	180/200	200	
<b>TOTALE</b>				<b>449</b>	<b>235</b>

Tab.A2.8: Results of the second survey carried out among transport operators.

## **M08.05 – Executive summary**

The city of Brescia is building a metro line (Metrobus). Its start-up is foreseen by 2013. Historically the city has not developed intermodal services and citizens had a mono-modal attitude. Only recently several initiatives aimed at promoting an intermodal transport system were developed. One is represented by Brescia Mobile Channel (BMC).

In this framework the measure is intended as a supporting action to promote a smart image of PT in the city and it consisted of developing different applications that should be:

- compatible with the operative system of mobile phones (for example Apple and Android);
- accessible from mobile devices, primarily Smart phones;
- able to exploit the device computing, storage and communication capabilities, both online (i.e. through cellular data network, wireless LAN and mesh networks, local connectivity/personal networks, etc.) and offline.

Brescia Mobile Channel (BMC) aimed at offering a variety of free services on mobile phones, while promoting the use of public transport in all the urban area (reached by buses). It has a set of functions grouped into three key areas, namely:

- i. “Take the bus more easily”: it’s possible to check the best line (or the best combination of bus lines) calculating the route starting from origin/destination data. A map of the city is always available containing also information about the public transport.
- ii. “Find useful services in the city”: the information shared through BMC comes from a wider information database, that contains information such as bike sharing stations, parking, police stations, schools.
- iii. “Use your phone as a payment system”: for PT tickets, parking tickets, promotional events tickets, etc. through the use of only the SIM card, thanks to an integrated NFC technology. (This activity has already started, but its full implementation is foreseen after the end of the Civitas project).

The application is characterized by several kind of information:

- RSS updated news about the bus lines deviations;
- the map layer, that allows to compare the Local Public Transport (LPT) trip to the one using a car;
- several city related information as bike sharing stations, car sharing stations, future metro stations, railway station, Limited Traffic zones (LTZ) accesses, parks, cycling paths, building sites, parking areas, etc.
- links to local newspapers (namely "Giornale di Brescia", "Brescia Oggi", "Corriere di Brescia", "Brescia news").

Information is updated in real time, like the number of available parking places, available bicycle of bike sharing service and bus timetables and journeys.

Considering that the application was developed both for iOS and Android OS, it allowed Brescia Mobilità to reach a larger amount of potential users, as the second operative system was more widespread than the first one. Actually, until September 2012, the total number of download of the iOS application was more than 3350 (published in November 2011) and for Android more than 650 (published in July 2012). From the first release published till September 2012 the app. was downloaded more than 3'350 times through the Apple store (the first app. was published in November 2011) and more than 650 times (the first app. was published in July 2012) by using Google play.

From the user view point the acceptance level is high since the people interviewed gave a vote of 4 out of 5 expressing their appreciation for the service. This good result is mainly related to the number of upgrades done to improve the quality of the product. BMC users had also the possibility to leave a comment after ending the connection to the app. By analysing these feedbacks together with back-office information it has been noted the following:

- The information updated in real time related to bike sharing and parking was highly looked upon.
- Thanks to the publication of dynamic info, the time connection of BMC sessions substantially increased.
- Android users seem to have less expectations than the iOS users and their comments are generally higher.

## **A. Introduction**

### **A1 Objectives**

The measure objectives are:

(NN) High level / longer term:

- To adopt the Intelligent Mobility Plan

(OO) Strategic level:

- To improve the PT quality of service spreading out information

(PP) Measure level:

- (1) To set up a system providing information on PT services and on the city through smart phones (such as information useful to commuters, personal infomobility services, city experience, shopping and tourism, health and wellbeing, etc.).

### **A2 Description**

The city of Brescia is building a metro line (Metrobus). Its start up is foreseen by 2013. Historically the city hadn't developed intermodal services and its citizens had a mono-modal attitude. Only recently several initiatives aimed at promoting an intermodal transport system were developed. One is represented by Brescia Mobile Channel (BMC). In fact this measure must be intended as a supporting action to promote a smart image of PT in the city.

The measure consisted in the development of different applications which are:

- compatible with the operative system of mobile phones (for example Apple and Android),
- accessible from mobile devices, primarily Smart phones
- able to exploit the device computing, storage and communication capabilities, both in online (i.e. through cellular data network, wireless LAN -Local Area Network- and mesh networks, local connectivity/personal networks, etc.) and offline settings.

Brescia Mobile Channel (BMC) offers a variety of free services on mobile phones, while promoting the use of public transport in all the urban area (reached by buses). Furthermore it's important to highlight that in Italy the spread of the smartphone use is high (considering the filed study carried out by Nielsen Italia in 2012, over 50% of mobile phones in commerce are smartphones), therefore the number of users reachable with the application (downloadable thanks to the internet connection available on mobile phones) is growing.

BMC makes a set of functions grouped into four key areas available, they are:

- *Take the bus more easily*: it's possible to check the best line (or the best combination of bus lines) calculating the route starting from origin/destination data. A map of the city is always available containing also information about the public transport.
- *Find useful services in the city*: the information that are shared through BMC come from a wider information database. This database is called Brescia Infomobility and is available on a common web

platform (<http://maps.bresciainfo.com/maps.aspx>). It contains information such as bike sharing stations, parkings, police stations, schools, etc. (more information will be available in the future).

- *Use your phone as a payment system:* for PT tickets, parking tickets, promotional events tickets, etc. through the use of only the SIM card, thanks to an integrated NFC technology. This activity has already started, but its full implementation is foreseen after the end of the Civitas project. .

BMC was developed also through the participation of ended users. They have been considered fundamental, for the application design.

The first developed application was realized for Apple smartphones, the second one was compatible with Android operative system (O.S.). These operative systems were chosen after a benchmarking activity related to their distribution in the national and international commercial scene. By the end of 2012, Android was installed on more than 60% of the mobile devices in commerce (less than 50% in 2011) and iOS on about 19% of devices (unchanged since 2011) (data source: International Data Corporation)

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## **B. Measure implementation**

### **B1 Innovative aspects**

#### **Innovative Aspects:**

- New conceptual approach
- Use of new technology/ITS
- Targeting specific user groups.

The innovative aspects of the measure are:

- **Innovative aspect 1 (New conceptual approach)** – An accessible information system is an important requirement for a PT company. This system must be constantly updated and upgraded, also through the use of new technologies. That is why the development of this "Mobile" communication channel can be considered innovative for Brescia, also from a conceptual approach.
- **Innovative aspect 2 (Use of new technology/ITS)** – The new technology exploited by the BMC is already known as "Intelligent Transport System" (ITS). The innovative aspects of this system can be summed up as follows:
  - *Flexibility* – all information is constantly updated. The system is organized in external structures that are coded (in standard format) and that can be easily changed without interfering with the application;
  - *Time-to-Market* – The system is based on target users (commuters), it offers customized services and allows reactivity for what concerns marketing actions.
  - *Reliability* – BMC is reliable for what concerns the networking infrastructure, operative system, application/database of the server;
  - *Upgrade* – the system is designed to allow upgrading (new functions can be implemented and the change of the basic components is granted). The system is user-friendly according to the different kinds of users' needs;
  - *Performance* – the waiting time (related to the selection/presentation of data, included maps and audio/video contents) is minimized in order to grant the full operability of the system itself.
- **Innovative aspect 3 (Targeting specific user groups)** – BMC is mainly addressed commuters and to teenagers who are one of the most important categories served by PT in Brescia, as they use PT to go to school, but soon drop it when they get off age and have a driving licence (at eighteen). The goal is to offer them a service which uses new technological devices, to promote a smart and effective PT.

### **B2 Research and Technology Development**

This measure was characterized by a relevant part dedicated to Research and Technology Development (RTD) activities. First of all, original contents and information-oriented mobile services addressed to the younger users of public transport services were defined. The approach to the BMC design was holistic. The stakeholders involved were: designers, usability specialists, Human Computer Interaction professionals and Brescia public transportation system experts.

There was an emphasis on balancing complex information with usability and engineering excellence with an up-front investment in sketching and ideation. Particular attention was paid to the design of accessible interaction techniques.

The system was developed to identify and show the best possible bus routes and other means of transport in the city on mobile devices, primarily smartphones.

The system exploited the computing device, storage and communication capabilities, both online (i.e. through cellular data network, wireless LAN and mesh networks, local connectivity/personal networks, etc.) and offline.

Besides PT information the system offered also city related information such as parks, cycling paths, building sites, parking areas, etc. through interactive mapping.

The map layer was provided by Google, by means of Google Transit. The service calculates routes, transit time and cost, and can compare the trip to the one using a car, particularly relevant in the perspective of Brescia transportation system and municipality.

A user centred design process was put in place to help BMC software designers to fulfil the goal of a product engineered for the final users. In this model, user requirements were considered right from the beginning and included into the whole product cycle.

During this phase, a benchmarking activity was organized in order to choose the most widespread operative system(s) among the ones already in commerce. This study showed a varied commercial scenario, in which the yearly increase of the smartphone users was about 30% by the previous one. At the beginning of Civitas MODERN Project, Symbian was the most widespread O.S. in commerce (in 2010 it was installed on 70% of the mobile phones in commerce, mainly on Nokia supports). This operative system wasn't open source and it was difficult to be used for the mobile application development. At the same time, iOS, designed by Apple, was installed on about 10% of smartphones in commerce. This one wasn't open source, but the possibility to develop non-Apple application was given with the realization of the SDK support (which is a software useful to simulate the iPhone on a pc). At the beginning of Civitas MODERN project, Android O.S., designed by Google, that was in embryo, was an open source system and installable on every kind of smartphone. These were the characteristics at the root of the fast spread of this last O.S. among the smartphones producers. Therefore, in light of this fast technological developments occurred during the RTD phase, the BMC was developed for iOS and Android (which represented about 80% of users at international and national level).

### **B3 Situation before CIVITAS**

Currently, the only way to reach citizens with up-to-date and portable information about public transport are paper, scheduled brochures, call centres, and web sites; each of them has its own limitations in terms of costs, reachability, availability, upgradability.

People are used to immediate communication through mobile phones, social networks, etc.

Thanks to Civitas contribution, the goal of the measure was to develop and offer free and friendly navigation services about Brescia PT network on citizens' mobile phones,

Information allow a better planning of public transport trips and modal split related choices.

### **B4 Actual implementation of the measure**

The measure was implemented in the following stages:

**Stage 1: Initial scenarios, requirements and business models definition and prototype design/specification** (from October 2008 to July 2009) – *The objective of this stage was to design the reference architecture and features of BMC using the assumptions of the existing open service platform.*

*Besides the reference architecture of BMC was designed coherently with the planned activities for the future development of Brescia Mobilità Web Portal, Brescia Mobilità manages the Local Public Transport (LPT) in Brescia, together with Brescia Trasporti s.p.a..*

*During the first months of this stage, the attention was focused on the general architecture and on the positioning of the components (Fig.1: the general architecture and on the positioning of the components).*



*Fig.1: the general architecture and on the positioning of the components*

*Then, a uniform definition of the user requirements was defined (each with a different level of in-depth specification).*

*The scope and objectives were studied by a Working Group (July 2009) in which the scenarios/requirements/business models definition and prototype design/specification were deepened.*

**Stage 2: Prototype development, evaluation and validation** (from July 2009 to July 2010) – *During this stage, a prototype of the application was developed and a test phase was set up in order to verify the info-mobile service.*

*The implemented application was based on the data, which periodically Brescia Mobilità s.p.a. provides to Google Transit support (in fact, each new level of transportation information services requires a change of the data transmitted to Google Transit).*

*In November 2009, a meeting with the application developers was arranged to analyze a first presentation of the trial version compatible with iPhone operative system.*

*In December 2009, the presentation of the demo application was organized, simulating it via internet with browser Safari, to begin the collection of comments about the functionalities being developed.*

*In January 2010, the actual start up of the demonstration test on an iPhone was carried out (see figure 2).*

*During January, February and March 2010 several tests were performed and application updates were released to obtain a version that could be used by some volunteer users.*



*Fig.2: design of BMC application: user interface and presentation layer*

**Stage 3: Requirements and business models refinement, system design/architecture/technical specification and development** (from July 2010 to October 2011) - Thanks to the prototype tests, it was possible to point out the necessary upgrades to be made before the release of the final application to be published on Apple Store.

Once this process was completed, a group of people, composed by volunteer students was involved in order to gather useful indications about further upgrades of the BMC application.

Some meetings were arranged to present the application and several feedbacks were collected. At the same time, the integration between the infomobility web portal and BMC was carried out, in order to synchronize the information available on the BMC. Brescia Mobilità decided to extract information directly from its own directly upgraded web portal instead of using the Municipality infomobility web portal ("BrescialInfo")

In the meantime, technicians updated the application, after verifying its compatibility with iPhone 4.

At the beginning Brescia Mobilità intended to sell the BMC application, but changed its mind since the first releases of the application were free because considered as experimental.

The first BMC app. was published on the Apple Store and it was free; furthermore it was considered comparable to the other free applications usually available on App Stores (both for iOS and Adroid operative system).

The final decision was to leave the application free of charge till after the start up of the metro service (by the beginning of 2013).

**Stage 4: Customer test, stakeholders' workshop and respective minutes** (from October 2011 to May 2012) - The selected group of students tested the services and solutions implemented to assess their technical and operational effectiveness and acceptance at different stages. A judgement about the reliability, scalability and flexibility of the system was investigated among the target group, as the device at their disposal was able to load the city/urban area map highlighting the interest points and to identify the best bus routs possible. Thanks to the students target group evaluation, some criticalities emerged in relation to the accessibility and to the in real-time updating of the information. Among the suggestions of the target group, the most important issues were related to the updated data of the free parking, available bicycle of the bike sharing service, the in real time information about the delays of the LPT buses and the possibility to access more easily to the LPT timetables. As described in the stage 5 "General public presentation and start up of the system", thanks to the collaboration with Sintesi s.p.a., it was possible to insert information about parking and bike sharing services. The collection of the target group opinions was arranged periodically, thanks to the compilation of a form, containing the following items: name-date, kind of OS (iOS or Android), evaluation of the application utilization, problems noticed, suggestions, weekly number of connections, level of satisfaction (from the lower 1 to higher 5), as reported in the figure 3.

Modulo di valutazione sistema Brescia Mobile Channel

Nome Testatore ..... Data .....

Modello Utilizzato iOS - Android

Impressioni d'uso:  
 .....  
 .....  
 .....  
 .....

Problemi riscontrati:  
 .....  
 .....  
 .....  
 .....

Proposte e Suggestimenti:  
 .....  
 .....  
 .....  
 .....

Misura 8.05

1) Numero di connessioni Settimanali .....

2) Grado di soddisfazione (Basso) 1 2 3 4 5 (Alto)

Fig.3: BMC application questionnaire addressed to the target group

**Stage 5: General public presentation and start up of the system** (from November 2011 to October 2012) - The application compatible with iOS was published as the first one for BMC and updated during the stage implementation. The first release was published in November 2011, compatible with iPhone 4, and it foresaw only the possibility to view all the bus lines. the second release (published in January 2012) consisted in the upgrade of the previous, adding bus timetables (in pdf format).

These app were mainly static, because the data weren't managed by a server.

The last version of the application was published at the end of August 2012 and this new release is dynamic.

Users can see in real time the available Bicimia bikes (bike-sharing) and free car parking.

This upgrade was possible thanks to the collaboration with Sintesi s.p.a. (the society which manages parkings and bike sharing service). Sintesi made the data available from it's server. A significant work was carried out to implement web services to make these data compatible with the iOS client format (SOAP -Simple Object Access Protocol- was the transmission protocol of the bike sharing and parkings data and "connector" services were implemented to translate and lighten the server data and to make them available on smartphone devices and processors. The processed data was sent to POI -Points of Interest- kml files which, through a parameter system, indexed the data and updated them directly in the correspondent category in POI section of the application). in particular, in POI section the information available were: parking, info point of Brescia Mobilità, metro stations, bike sharing stations, police, hospitals, taxi stations, railway station, car sharing parkings spaces, LTZ access road sections, etc.).

Finally a new release of the application was tested for the compatibility with iOS6, through the use of the SDK -Software Development Kit- 4.5 simulator. This was functional to this latest update of the operative system of Apple smartphone and tablet (as a matter of fact, the iOS6 is the same for iPhone and iPad, therefore the application is also installable on iPad).

*The content of this new release was related also to the introduction of dynamic information system about bus lines and timetables. The release has not been published on the store yet, but it has already been submitted for publication*

*It is important to underline that before the design of this last release, the server was improved in order to make Brescia Mobilità able to directly update information about buses.*

*The new dynamic data system allowed to join lines with timetables downloading only useful data.*

*As, before the publication, every release written for iOS needs to be submitted to Apple review procedures, which last about two weeks or more.*

*During this stage, also an application for Andorid OS was made and at the end of July the first release was published on Android App Store.*

*This application and its download is free (users' interface is reported in figure 4).*

*It's important to point out that the first Android release has different contents from the first one designed for Apple as it takes into account the comments made by Apple users through the web survey.*

*The second release for Android was published at the end of September 2012, within the European Mobility Week and the third release was published at the beginning of October 2012.*

*This last application has the same information of the iOS6 one. It offers information in real time of bike sharing bicycles available and parkings available, bus lines, timetables and news. Every release written for Android OS is published through "Google play": this procedure takes only few working days.*



Fig.4: Design of Android BMC application: user interface and presentation layer

*This stage was important for the design and for the implementation of the quality of the releases as an evaluation system was introduced on the stores.*

*The evaluation system consisted in a pop up, which was shown to the application user after a certain time, during which the user himself used BMC.*

*In the pop up message a synthetic opinion was asked using "stars" for evaluation (and brief comments for particular suggestions). All opinions were sent to the application administrator. This kind of evaluation system was implemented on iOS from June 2012 (by an update of the release) and for Android from 27<sup>th</sup> of July (directly on the first release).*

*During this stage a test phase regarding the payment of the application was foreseen, but this wasn't done because both applications for Apple and Android still are free of charge.*

**Stage 6: Dissemination** (from March 2009 to October 2012) – *The dissemination activity was fundamental, in order involve stakeholders in the realization of the application.*

*Dissemination activities mainly consisted in meetings with potential users and volunteers - selected among University of Brescia students (see figure 5 reported below)- , to collect suggestions on the possible upgrades. Then, communication campaigns and official*

*presentations of the app - such as during the European Mobility Week held on September - were arranged to launch the service to the public.*



*Fig.5: Meeting with the students for the presentation of the BMC prototype (Nov 19<sup>th</sup> 2010)*

## **B5 Inter-relationships with other measures**

This measure from the theoretical point of view has potential interactions with all the other measures proposed in Brescia, using Civitas plus funding, to develop a smart image of the city after metro start up foreseen by 2013..

The afore mentioned image of the city is given by both Brescia Mobility Channel and the following measures:

- **Measure 1 no. 02.03** “Development and upgrade of the e-ticketing system”;
- **Measure 2 no 02.02** “Intermodality with public transport”;
- **Measure 3 no 03.03** “P&R facilities for underground and public transport system”.

From the quantitative point of view there isn't interaction among indicators, as for this measure the indicators were set up to measure the use of the app..

## C. Evaluation – methodology and results

### C1 Measurement methodology

Brescia Mobile Channel (BMC) could be an effective support for commuters providing information not only about LPT transport (buses and metrobus – which start up foreseen by 2013), but also about other mobility services of the city, such as bike sharing, car sharing, parking.

The indicators pointed out for the measure evaluate the set up the system developed for smartphones both for iOS and Android OS. In particular, the evaluation objective was to monitor the spread of the smartphone application, through the downloads and the awareness level from Brescia Mobilità survey, and the customer satisfaction, through the direct evaluation and the acceptance level from Brescia Mobilità survey, which may change after every application update. Furthermore, the "Economy" indicators, chosen in the beginning of the project, when the BMC was designed to be downloaded for a fee, weren't collected because it was decided to publish free the application.

#### C1.1 Impacts and Indicators

Table C1.1: Indicators.

No.	Impact	Indicator	Data used	Comments
1	Economy	N. of downloads of the BMC application	Server connections tracking, provided by the application manager	First data collection after the o.p.in January 2012
2	Economy	Total cost/Cost of estimated (or target) users		No more collected as the BMC is free for customers
3	Economy	Total cost/Cost of real users		No more collected as the BMC is free for customers
4	Transport	Number of satisfied customers	Satisfaction index from comments recorded in iTunes Apple and Android application store	No ex ante foreseen.
5	Society	Awareness level	BST customer (specific question)	
6	Society	Acceptance level	BST customer (specific question)	

Detailed description of the indicator methodologies:

- **Indicator 1** (*N. of downloads of the BMC application*) – This indicator is collected tracking the number of users who downloaded BMC from the App store, in order to monitor the success of the initiative.
- **Indicator 2** (*Total cost/Cost of estimated (or target) users*) – the BMC application is free for customers, therefore indicator was no longer collected.
- **Indicator 3** (*Total cost/Cost of real users*) - the BMC application is free for customers, therefore indicator was no longer collected.

- **Indicator 4** (*Number of satisfied customers*) - In order to monitor this indicator, a specific evaluation by the BMC users was performed. A temporary “block” (both on iOS and Android) into the BMC app (that can be unlocked answering to a fast set of questions) was implemented. These answers were collected to evaluate the applications and to update them
- **Indicator 5** (*Awareness level*) and **Indicator 6** (*Acceptance level*) - In order to monitor the selected indicators, before and after the release of the BMC application, specific questions were introduced in the “standard” customer satisfaction survey regularly carried out by Brescia Trasporti, namely:
  - awareness level about the BMC application;
  - general use of Smart Phones for data exchange;
  - in case of positive answer to the previous question, the following question was put: Acceptance level toward the BMC application.

## C1.2 Establishing a Baseline

Brescia Mobilità s.p.a. (Brescia mobility company) for years has aimed at promoting the use of public transport making the information about transports modes in Brescia more accessible.

Before the participation to the Civitas project, information about the Local Public Transport (LPT) service were the paper bus timetables brochures, the info points distributed in the city centre, the call centres and the dedicated web site.

The Civitas measure consisted in implementing a modern tool for the access to the information concerning the mobility of the city (the Brescia Mobility Channel application for smart phones) that didn't exist before, therefore, the baseline for the selected indicators is referred to year 2010.

Indicators 1 (N. of downloads of the BMC application) and 4 (Number of satisfied customers) were selected to monitor the success of the released application, after the publication on the AppStore in November 2011 and on "Google Play" Store in July 2012. The Baseline value for these indicators is therefore 0.

Indicators	Baseline (November 2010)
1. N. of downloads of the BMC application	0
4. Number of satisfied customers	0

*Tab.1: baseline of indicators 1 and 4*

Also the remaining indicators n. 5 and 6 (awareness and acceptance level) are referred to the launch of the BMC application, they monitor its success among the LPT users in terms of promotion (ind. 5) and they investigate the attitude of the LPT users toward innovative devices like the smart phones to collect the desired information (ind.6).

In order to evaluate these aspects of the BMC initiative, the indicators were collected in November 2010 (about one year before the release of the application) and their values were taken as reference for the baseline situation.

Indicators	Baseline (November 2010)
5. Awareness level	1,8 %
6. Acceptance level	62,7 %

*Tab.2: baseline of indicators 5 and 6*

### C1.3 Building the Business-as-Usual scenario

The building of the BaU scenario was carried out on qualitative assumptions, mainly based on the interview made by the Brescia Evaluation Group to the Brescia Mobilità SpA General Director in July 2011. In that occasion he said that without the Civitas contribution, probably the Brescia Mobile Channel wouldn't have been developed. As a matter of fact, the participation to Civitas allowed to develop this initiative, that otherwise wouldn't have had priority respect to other initiatives concerning metrobus. As a consequence, the BaU scenario (time horizon 2012, before the metro start up) for all the indicators concerning the launch of the BMC application have 0 value.

Also the indicators n.5 and 6 (awareness and acceptance level) have 0 value because no promotional activity on BMC application would have been done and the potential interest (acceptance) toward the BMC app wouldn't have been investigated.

Indicators	BaU (2012)
1. N. of downloads of the BMC application	0 (no service)
4. Number of satisfied customers	0 (no service)
5. Awareness level	0 (no service)
6. Acceptance level	0 (no service)

Tab.3: BaU of indicators 1, 4, 5 and 6

## C2 Measure results

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

### C2.1 Economy

Table C2.1.1: Results obtained for the Indicators corresponding to area “economy”

Indicator	Before	After	BaU	Difference: After – Before	Difference: After – B-a-U
1. N. of downloads of the BMC application	Not scheduled	<b>iOS Application:</b>		Not Assessable	Not Assessable
		November 2011: 656	November 2011: 0 (no service)		
		December 2011: 355	December 2011: 0 (no service)		
		January 2012: 435	January 2012: 0 (no service)		
		February 2012: 256	February 2012: 0 (no service)		
		March 2012: 232	March 2012: 0 (no service)		
		April 2012: 261	April 2012: 0 (no service)		
		May 2012: 225	May 2012: 0 (no service)		

		June 2012: 153	June 2012: 0 (no service)		
		July 2012: 192	July 2012: 0 (no service)		
		August 2012: 183	August 2012: 0 (no service)		
		September 2012: 435	September 2012: 0 (no service)		
		<b>Android Application:</b>			
		July 2012(from 27 <sup>th</sup> of July): 27	July 2012(from 27 <sup>th</sup> of July): 0 (no service)	Not Assessable	Not Assessable
		August 2012: 234	August 2012: 0 (no service)		
		September 2012: 401	September 2012: 0 (no service)		

From the first release published till September 2012 more than 3350 were downloaded by Apple store (the first app. was published in November 2011) and more than 650 (the first app. was published in July 2012) were downloaded by Google play.

In Italy more than 24 millions of smartphones were sold ("Il Sole 24 ore", 27<sup>th</sup> of July<sup>22</sup> 2012) and actually Android represents more than 64% among the operative systems available and iOS about 18,8%.

From this data is evident the potentiality of the measure that uses smartphones to spread out dynamic information related to city mobility and to Public transport services available.

## C2.4 Transport

**Table C2.4.1: Measure results for the indicators of the category "Transport"**

Indicator	Before	After	BaU (2012)	Difference: After – Before	Difference: After – B-a-U
4. Number of satisfied customers	Not scheduled	4/5 (average of the evaluation on app from 1 to 5)	0 (no service)	Not Assessable	Not Assessable

The value 4/5 highlighted the app. potentiality and the appreciation of the customers (The pop-up was implemented on iOS by Summer 2012 and on Android by the first release, also published in Summer 2012).

<sup>22</sup><http://www.ilsole24ore.com/art/impresa-e-territori/2012-07-27/solo-smartphone-salvano-spesa-064425.shtml?uid=AbkZgUEG&fromSearch>

[http://www.ilsole24ore.com/pdf2010/SoleOnline5/Oggetti\\_Correlati/Documenti/Tecnologie/2012/08/mercato-cellulari-sistema-operativo.pdf?uid=f26f4776-e607-11e1-8021-95f069af09c4](http://www.ilsole24ore.com/pdf2010/SoleOnline5/Oggetti_Correlati/Documenti/Tecnologie/2012/08/mercato-cellulari-sistema-operativo.pdf?uid=f26f4776-e607-11e1-8021-95f069af09c4)

For further information "Ict Market Report 2012/13" published by Eito (European information technology observatory) or Gartner (information technology research and advisory company) in the second four-month period of 2012 called "Worldwide Mobile Device Sales to End Users by Operating System in 2Q12"

This good result is mainly related to the number of upgrades done to improve the quality of the product.

Some consideration about the application can also be pointed out using the comments done by the BMC users and the time of connection of users sessions:

- the information updated in real time related to bike sharing and parking was highly regarded.
- by the publication of dynamic info, the time connection of BMC sessions substantially increased.

Android users seem to have less expectations than the iOS users and their comments are generally higher. This is important issue in relation to transferability.

## C2.5 Society

**Table C2.5.1: Measure results for the indicators of the category “Society”**

Indicator	Before (November 2010)	After (April 2012)	BaU (2012)	Difference: After –Before	Difference: After – B-a-U
5. Awareness level	1,8 %	25,6%	0 (no service)	23,8%	Not Assessable
6. Acceptance level	62,7 %	21,3%	0 (no service)	-41,4%	Not Assessable

The specific questions in the customer satisfaction survey about the BMC were:

- Have you been informed about the Brescia Mobile Channel initiative? (Awareness)
- Are you interested in having an app. providing information about mobility services on your mobile phone? (Awareness)
- Do you think that an infomobility service will be useful for you to move in the city?
- Would you be ready to connect (paying mobile connection) to download updates of dynamic information, as free parking spaces and information about bike sharing stations? (Acceptance)

In order to explain these results about awareness and acceptance level, it was considered important to highlight that customer satisfaction surveys were carried out with the same sample size at different moments, therefore the involved people were different. No specific information campaign was carried out just before the interviews. Even if the awareness level increased from 2010 to 2012, the acceptance level about BMC decreased from 62,7% (2010) to 21,3% (2012). It can be explained considering the kind of question used to measure the acceptance. As a matter of fact, at the beginning of the project, the application was considered static in relation to the mobility information. Therefore, it wasn't necessary to pay the mobile connection to download information. After the first BMC releases, it was possible to implement information updated in real time, therefore the question related to the acceptance was integrated, asking to the interviewees if they would pay the mobile connection to download this new kind of information. The positive answers to the question decreased as only the actual application users accepted to pay the mobile connection. However, it's important to highlight that the in real time updated information were considered very useful by the actual users. Therefore, it was decided to maintain the application free and also to maintain the dynamic information.

## C3 Achievement of quantifiable targets and objectives

No.	Target	Rating
1	Set up of a system providing information services based on context awareness and	**

	<p>urban community involvement</p> <p><i>This objective can be divided into two ones:</i></p> <p><i>1)Application for iOS: the community involvement was measured by ind. 1(N. of downloads of the BMC application).</i></p> <p><i>After (September 2012): 3383</i></p> <p><i>2) Application for Android OS: the community involvement was measured by ind. 1(N. of downloads of the BMC application).</i></p> <p><i>After (September 2012): 662</i></p>	
<p><b>2</b></p>	<p>Information on the city and news</p> <p><i>The implemented app. gives the information about the city and news about this one (Giornale di Brescia e Corriere-Brescia are two local newspapers available since the BMC through release 1.0.1). Therefore the objective was considered achieved in full</i></p>	<p><b>**</b></p>
<p><b>NA = Not Assessed    O = Not Achieved    * = Substantially achieved (at least 50%)</b>  <b>** = Achieved in full    *** = Exceeded</b></p>		

## **C4 Up-scaling of results**

The BMC application was developed for all the city and it available for all the potential users (not only Brescia citizens) since the release publication is free for iOS and for Android OS.

Therefore, it not seem significant to up-scale the measure.

## **C5 Appraisal of evaluation approach**

The evaluation approach was based on the project's objective as expressed explicitly in the Evaluation Plan. The approach adopted and used collects the most salient data for the indicators collection, that have to be conveniently chosen in order to monitor the achievement of the measure objectives, especially at a local level.

The indicators were selected at the beginning of Civitas project and the chosen ones belong to the following categories: Economy, Transport and Society.

The indicator 1 ("N. of downloads of the BMC application") was able to monitor the interest of users in the new communication channel, designed and developed during Civitas project.

According to the Annex A of this measure, elaborated for the III year of the Civitas project, namely under the Task 08.05.19 "Evaluation: data collection and monitoring", respect to the original project, the BMC application was published free for all users, therefore indicators 2 ("Total cost/Cost of estimated (or target) users") and 3 ("Total cost/Cost of real users") weren't collected.

The indicator 4 ("Number of satisfied/interested customers"), was related to the Transport category, was collected in order to monitor the level of satisfaction of the actual users. Using the app. after a certain time of the application actual use the following question was put the users: Could you express your satisfaction level about the app.? ( quality assessment is made trough stars)

Indicators 5 ("Awareness level") and 6 ("Acceptance level") were chosen in order to evaluate the interest among the citizens in Brescia (which can be actual users of the app or not, actual users of LPT or not, etc.) about the new mobile application. As already mentioned the following questions had been put during customer satisfaction surveys:

- Have you been informed about the Brescia Mobile Channel initiative? (Awareness)
- Are you interested in havig an app. providing information about mobility services on your mobile phone? (Awareness)
- Do you think that an infomobility service will be useful for you to move in the city?
- Would you be ready to connect (paying mobile connection) to download updates of dynamic information, as free parking spaces and information about bike sharing stations? (Acceptance)

These three specific questions allowed to collect the data; in particular both the ex ante and ex post answers were collected.

## **C6 Summary of evaluation results**

The key results are as follows:

- **Key result 1** – it was possible to design a “smart” mean of information, related with the view of a "smarter city", also in the occasion of the new metro start up by 2013.
- **Key result 2** – Brescia Mobile Channel was published and constantly improved, taking into consideration also the suggestions from mobile users. Actually, the application provided information about LPT (bus lines, timetable, etc.), bike sharing (free parking spaces, number of bicycle available for each station, etc.) in real time. The application provides also information with news about the city (for example, from local newspapers on line editions).

- **Key result 3** – dynamic information (real time) is more appreciated than the static one, the already submitted release is able to manage all mobility info in real time both for Android and for iOS.
- **Key result 4** – the application was developed both for iOS and Android OS. This choice allowed Brescia Mobilità to reach a larger amount of potential users, as the second operative system was more widespread than the first one, reaching more than the 75% of smartphone market.

### **C7 Future activities relating to the measure**

A constant upgrade of realises is foreseen until the start up of the metrobus. The most important upgrade will be done in relation to the metro start up by 2013, in which new bike sharing stations, and the update considering the new bike sharing stations, which will be installed next to every metrobus station.

Info updated after the final submission of the MERT in October 2012 and already reported in the Annex A of the measure (POINTER revision received on January 2013):

The last release for iOS was published on the Apple Store at the end of October 2012.

## **D. Process Evaluation Findings**

### **D.0 Focused measure**

This measure is not a focused one.

### **D1 Deviations from the original plan**

- **Delay of the application publication for iOS** - the publication of an application on Apple Store requires the evaluation by the service manager and it takes almost two working weeks. As the first releases were published on App store, their updates required time; in addition, before the publication of the first release, there were some problems related to the compatibility with the iPhone4 and iPhone 4S. These difficulties had an effect on Android device, the publication of which was delayed.

### **D2 Barriers and drivers**

Barriers, drivers and actions can be different according the various stages of the measure and linked to the actual conditions.

#### **D2.1 Barriers**

In the sequel main barriers, which have been picked out during the measure implementation, are pointed out:

##### **Preparation phase**

- **Planning barrier** - the choice to start from the application compatible with the iOS required more time, considering many updates of iOS occurred during the measure implementation. These ones caused delays and problems for the application design.

##### **Implementation phase**

- **Technological barrier** - after the iPhone 4 launch, the release of the BMC application for iPhone was delayed for incompatible development tools used for the new device. Therefore the supplier rewrote the application considering the new system environment features.

##### **Operational phase**

- **Planning barrier** - the necessity of Apple store to evaluate all the applications before their publication was considered a barrier. As a matter of fact, it has taken almost 2 weeks and the updating process was slackened. Whereas, the Android application store evaluation usually takes few working days.

#### **D2.2 Drivers**

In the sequel main drivers, which have been picked out during the measure implementation, are pointed out:

##### **Preparation phase**

- **Financial driver** - the availability of Civitas fund was important in order to develop an Infomobility application for mobile devices. This application was considered important for the spread information about the means of transport in Brescia, related to the position of the points of interest (for example, parking, bike sharing stations, etc.).
- **Political/strategic driver** - The BMC application was considered important also in the view of the new metro start, in order to promote an intermodal aptitude of citizens, which have to be informed of the possibility of intermodality among different means of transport. The means of transport information allowed users to chose the kind of journey, considering the time it could keep.
- **Political/strategic driver** - through the smartphone application, it was possible to improve the new image of Brescia as a "smart city". Actually, the new communication mean was considered a fundamental topic in a modest sized city as Brescia, also in the view of the metro start up (2013).

#### **Implementation phase**

- **Organizational driver** - in order to share data about the Infomobility Project, it was important to highlight the necessity to carry out a constructive partnership with the Municipality. Thanks to the information sharing, it was possible to implement a more complete service to users (actual end potential).

## **D2.2 Activities**

#### **Implementation phase**

- **Target group organization** - The activity consisted in the organization of the Target Group, involving the Measure Leaders, responsible for measures which are part of the Metro Package (M02.03 "Development and upgrade of the e-ticketing system in Brescia", M02.02 "Intermodality with public transport in Brescia", M03.03 "P&R facilities for underground and public transport systems in Brescia"), in order to share the expectations of the this specific communication channel and its management modes. as a matter of fact, the close examination of the intermodality potentialities as been considered fundamental.

#### **Operational phase**

- **Strict collaboration with application designers** - an important topic, which helped in the measure success was the strict collaboration among Brescia Mobilità and the designers of the application. It was necessary not only to get over problems related with the information to give (for example, bus lines and timetables updated), but also to satisfy as possible the users direct requests about new information to be added to the application.

## **D3 Participation**

### **D.3.1 Measure partners**

- **Brescia Trasporti s.p.a.** - the partnership was considered fundamental. As a matter of fact, in the application information about LPT has been implemented and it was necessary to create a database (not existing before Civitas project) to manage easily the data about bus lines and timetables (not using pdf format, as the existing web site do) also on mobile device.

- **Sintesi s.p.a.** - this society, which has managed parking and bike sharing services in Brescia, had an important role in the implementation of real time information about the free parking spaces and bicycles (of bike sharing) available in each station. The connection between the BMC application and the Sintesi database was direct and updated in real time.
- **Application designer for iOS and Android OS** - The strict collaboration among designers and Brescia Mobilità was considered necessary to develop the application, as suitable as possible to the users requirements. It was important to highlight also the necessity to update the published releases, considering the several updates of both the operative systems.

### D.3.2 Stakeholders

- **Brescia Municipality** - considering that the BMC implemented also information about the city (newspapers links and points of interest), it has been involved to share and define the kind of information, which have been considered important and useful for users.
- **Bike sharing, LPT and parking actual users** - the actual users were considered fundamental stakeholders, as the BMC made available through only one communication channel several information about means of transports, which can be potentially integrated. As a matter of fact, the information updated in real time were especially appreciated by actual users.

## D4 Recommendations

### D.4.1 Recommendations: measure replication

- **Easily replicatable functions of the smartphone application** - This application can offer a set of functions that can be easily replicated in other cities, innovating and deploying a new personal navigation paradigm based on the evolving capabilities of smartphones. The image of smart intermodality can be implemented by the use of an app like the BMC. As a matter of fact thanks to the smartphones, it is possible to provide also information updated in real time, to actually implement the integration among different means of transport (such as, LPT, bike sharing, parking, car sharing, etc.).
- **Use of Google Transit** - It's important to highlight that the choice to publish the urban and suburban buses network on Google Transit allowed the developer not to update the application when the routes or timetables change, but it is sufficient to update the information on Google Transit. When users access the application, he automatically finds updated information

### D.4.2 Recommendations: process

- **Strict collaboration with designer to the success** - the strict collaboration with the designer and users (as a group of expertises) of the application is considered fundamental for the success of the measure, in order to solve the technical problems related to the smartphone operative systems. Furthermore, the application update has to be as constant as the mobile operative systems one, in order to ensure the compatibility with smartphone device.
- **Test the acceptance level of new mean of information** – it was considered important to study in-depth the acceptance and the interest of actual and potential users of a new mean of information, based on a smartphone application. It's possible to carry out this study, for example, through specific surveys. This step allows to design an application more suitable to the citizens needs and direct requests.

- **Start from the most widespread OS** – it's recommendable to start the develop of a new device, as BMC, considering the most widespread OS and also the less restricted one, as Android OS. As a matter of fact, it's easier to design the application, with less problem of compatibility. After this step, it has been considered useful to shift the design on more sectional operative systems, as iOS. Furthermore, it's important to highlight that Android store evaluation of application usually takes few working days, the Apple store evaluation almost 2 working weeks. This fact has to be considered to calibrate the time to be dedicated to the necessary updates of the application.
- **Chose the most interesting information** – it was highlighted that the quality of the information provided with the application influenced the actual use of this one, after the download on a smartphone. As a matter of fact, for example, the information updated in real time have been really appreciated by actual users.
- **Free download in the first application development and updates** – it is advisable, at the beginning, to publish the application with a free download. Only after an important improvement of the available information and a certain period of experimentation, it has been considered feasible to demand a payment for the application download to who doesn't have active season ticket of bike sharing, car sharing, LPT (urban and suburban), parking and other public means of transport.

## Annex 1: Ex ante and Ex Post data collection

- **Indicator 1** (*N. of downloads of the BMC application*) – No ex ante foreseen.

**First data collection** (17 January 2012, after a short period after the release of the BMC app on the Apple Store – November 2011). This indicator is collected tracking the number of users who downloaded BMC from the App store, in order to monitor the success of the initiative.

### AFTER DATA COLLECTION:

Year	Month	iOS application downloads per month
2011	November	656
	December	355
2012	January	435
	February	256
	March	232
	April	261
	May	225
	June	153
	July	192
	August	183
	September	435

*Tab.A1.1: iOS application downloads per month*

Year	Month	Android OS application downloads per month
2012	July	27
	August	234
	September	401

*Tab.A1.2: Android OS application downloads per month*

- **Indicator 2** (*Total cost/Cost of estimated (or target) users*) – **NO MORE COLLECTED**
- **Indicator 3** (*Total cost/Cost of real users*) - **NO MORE COLLECTED**
- **Indicator 4** (*Number of satisfied customers*) - In order to monitor this indicator, two kind of evaluation activities are foreseen: Specific questions to the BMC users will be made. A temporary “block” into the BMC app (that can be unlocked answering to a fast set of questions) has been implemented.  
  
4/5 (average of the evaluation on app from 1 to 5)
- **Indicator 5** (*Awareness level*) and **Indicator 6** (*Acceptance level*) – In order to monitor the selected indicators, before and after the release of the BMC application, specific questions are introduced in the “standard” customer satisfaction survey regularly carried out by Brescia Trasporti. This standard survey is made 3 times a year interviewing the users about general aspects of the LPT bus service. The interview amount is 1200. People are interviewed at the bus

stop and by phone. For the interviews at the bus stops, the bus stops are selected with a particular focus on terminals or on specific lines; for the phone interviews a casual extraction among the people registered in the lists of the holders of Omnibus Card is made according to the typology of trip loaded. 700 questionnaires are proposed face to face at the bus stops and/or on the busses of Brescia Trasporti and 500 are proposed by phone interview according to the references of Brescia Trasporti. The activity has been planned associating traditional surveys (structured questions, semi structured and open ones) and innovative methodologies tested by Summa (the company in charge of making the surveys) that allows to manage the information coming from indirect survey. According with the methodologies used, the interviewee is able to express its position or opinion about certain subject without preconceived answers and taking over all content delivered spontaneously. The obtained indications are introduced into a dynamic database and analyzed carefully, focusing on key concepts and on the additional ones, and it is possible to draw assessments and rigorous statistics, qualitative in-depth.

Table XXX **The evolved informative system**

100% total people involved  
 100% gave the personal information to characterize the sample

Variables pointed out

Questions subjects	Absolute number	Percentage (%)	Closer Analysis tables
Awareness about the Brescia Mobile Channel application	<b>XXXX</b>	<b>XXXX</b>	.....▶ Tab.XXX
Interest to have mobility information on own smartphone	<b>XXXX</b>	<b>XXXX</b>	.....▶ Tab.XXX
Acceptance towards the necessity to download information about city mobility through internet connection on own phone	<b>XXXX</b>	<b>XXXX</b>	.....▶ Tab.XXX

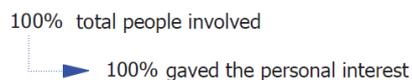
Table XXX **Awareness level about the Brescia Mobile Channel application**

100% total people involved  
 100% gave the personal information to characterize the sample

Have you been informed about the Brescia Mobile Channel initiative?

Answers	Absolute number	Percentage (%)	Medium opinion of the sample
Yes	<b>XXX</b>	<b>XXX</b>	<b>XXX</b>
No	<b>XXX</b>	<b>XXX</b>	<b>XXX</b>

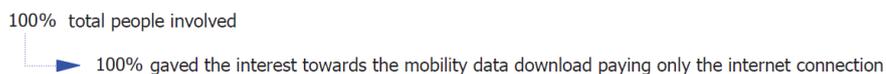
Table XXX **Interest to have mobility information on own smartphone**



Are you interested in having an app. providing information about mobility services on your mobile phone?

Answers	Absolute number	Percentage (%)	Medium opinion of the sample
Yes	XX	XX	XXX
No	XX	XX	XXX

Table XXX **Acceptance towards the necessity to download information about city mobility through internet connection on own phone**



Would you be ready to connect (paying mobile connection) to download updates of dynamic information, as free parking spaces and information about bike sharing stations?

Answers	Absolute number	Percentage (%)	Medium opinion of the sample
Yes	XXX	XXX	XXX
No	XXX	XXX	XXX

Fig.A1.1-A1.2-A1.3-A1.4: example of the form used during the data collection of Awareness and Acceptance

**EX ANTE DATA COLLECTION (November 2010):**

Specific questions has been introduced in the “standard” customer carried out in **November 2010**, namely:

1. Awareness level about the BMC application;
2. General use of Smart Phones for data exchange;
3. In case of positive answer to the previous question, the Acceptance level toward the BMC application.

**Results:**

	YES	NO	Totals
1. Awareness level about the BMC application	22 (1,8%)	1180	1202
2. General use of Smart Phones for data exchange	51 (4,4 %)	1151	1202

3. In case of positive answer to the previous question, Acceptance level toward the BMC application	32 (62,7 %)	19	51
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*Tab.A1.3: iOS application downloads per month*

ind. 5 Awareness level about the BMC application = 1,8 %

ind. 6 Acceptance level toward the BMC application = 62,7 %

**AFTER DATA COLLECTION (April 2012):**

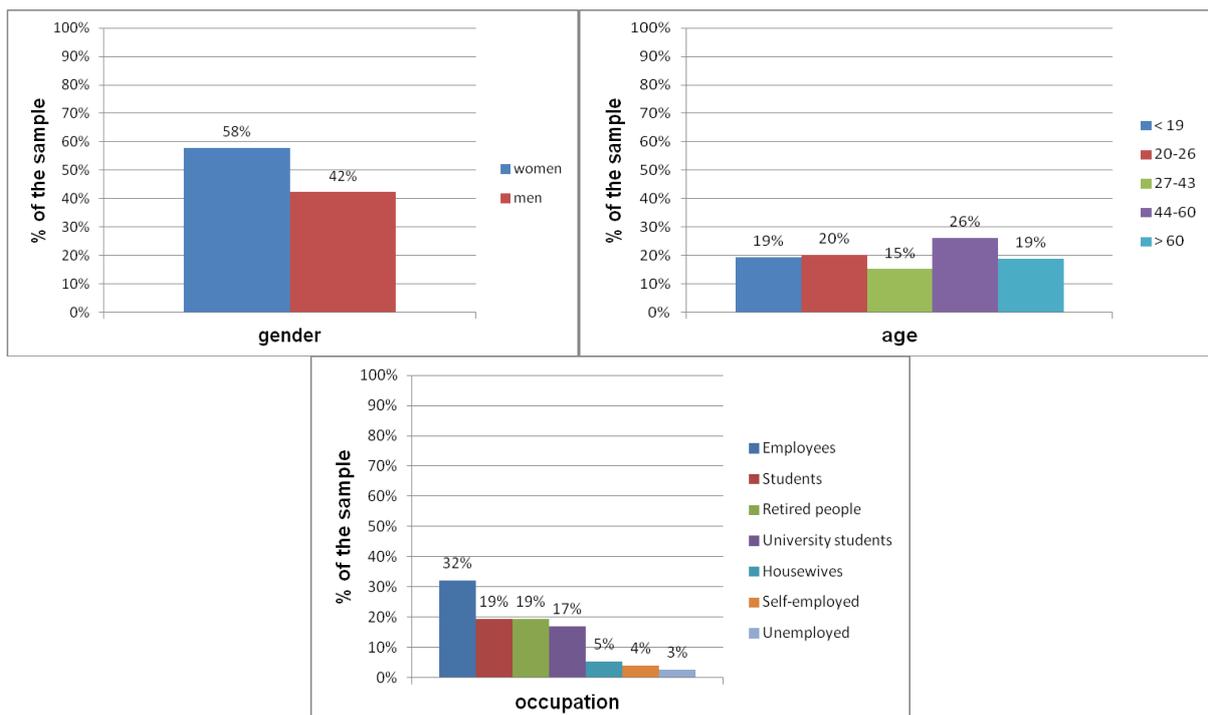
	YES	NO	Totals
1. Awareness level about the BMC application	307 (25,6%)	903	1230
2. General use of Smart Phones for data exchange	86 (7,2 %)	1144	1230
3. Acceptance level toward the BMC application	263 (21,3 %)	967	1230

*Tab.A1.4: iOS application downloads per month*

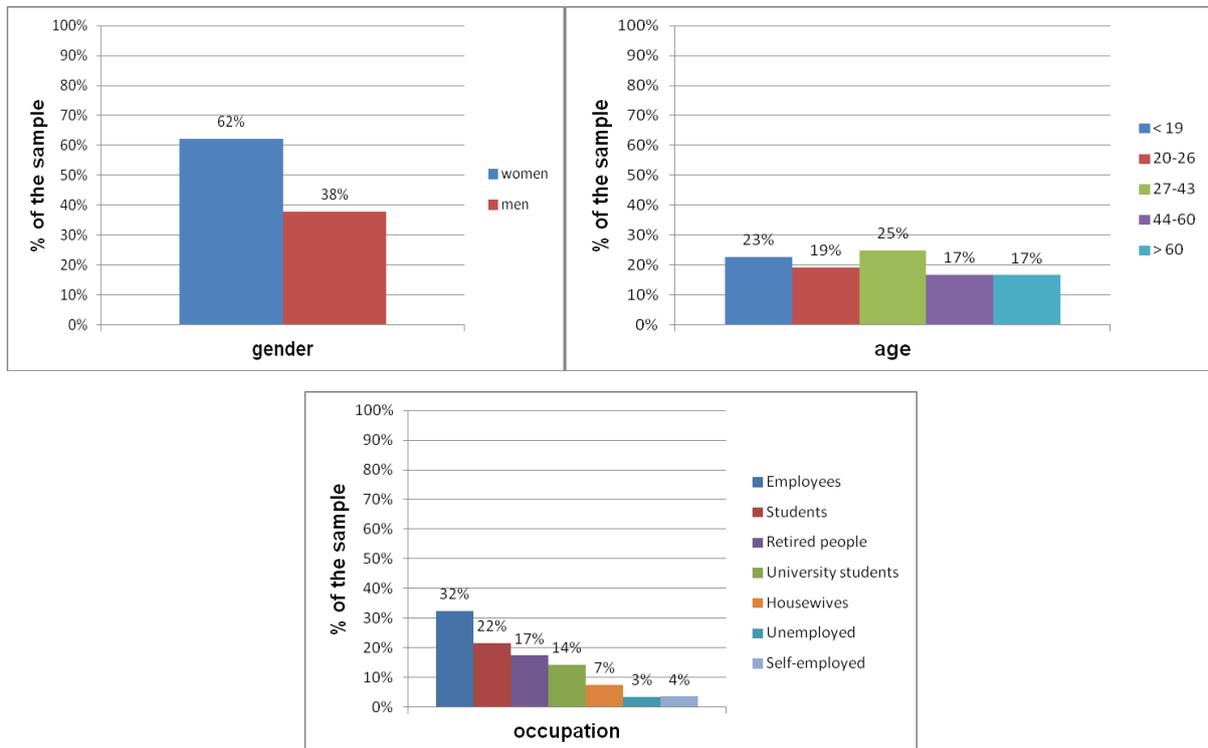
ind. 5 Awareness level about the BMC application = 25,6%

ind. 6 Acceptance level toward the BMC application = 21,3 %

As regards the sample composition customer satisfaction survey, in the figures below are reported the characteristics related to the questionnaire carried out in November 2010 and in April 2012.



*Fig. A1.5-A.6-A1.7: Information about gender, age and the occupation of the sample involved in the customer satisfaction survey in November 2010*



*Fig. A1.8-A1.9-A1.10: Information about gender, age and the occupation of the sample involved in the customer satisfaction survey in April 2012*

## Annex 2: Focus Group Activities

	Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
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<b>Title</b>	<b>Impostazione dei Focus Group</b>
<b>Metro Package measures</b>	M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel
<b>Other stakeholders</b>	- Brescia Municipality - Sutera - Verità

STEP 1	<b>Accoglienza e riscaldamento (circa 10 minuti)</b>		
	1) Presentazione degli invitati al gruppo di discussione. 2) Presentazione dei ricercatori.		
STEP 2	<b>Introduzione al tema della discussione (circa 10 minuti)</b>		
	3) Motivazione e condizioni (fasi e tempi) dell'incontro di gruppo in data _____ - Metro Package (MP); - lighthouse measures; - indicatori.		
STEP 3	4) Gli obiettivi dell'incontro sono:		
	- condivisione metodologia per lo svolgimento del Focus Group; - attuazione del Focus Group.		
STEP 3	<b>Fasi della ricerca: descrittiva, riflessiva e propositiva</b>		
	<b>TEMA</b>	<b>MISURA</b>	<b>METROPACKAGE</b>
	Azzeramento della conoscenza e condivisione degli input (ipotesi scenari)		
	Potere decisionale in relazione al tipo di scelta da attuare		
	Percezione di rischi/problematich e oltre Civitas (ad esempio, entrata in esercizio della metro)		
STEP 4	<b>Verifica di fattibilità e scelta finale</b>		
	<b>Assegnazione dei ruoli</b>		
STEP 6	<b>Sintesi dei risultati:</b>		
	- per singola misura; - per Metro Package		

Fig.A2.1: General structure of the Focus Group activities

		Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>		<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>		M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>		- Brescia Municipality - Sutera - Verità		
<b>MEETINGS</b>		<b>Partner</b>	<b>PRESENCE</b>	
Date: <b>15 november 2011</b>		Brescia University	Bulferetti, Cadei, Ferrari	
		BSM	Sbardella, Gussago, Ragnoli, Pace	
		BST	Sutera	
		CBS	Bresciani	
		BICIMIA	Verità	
<b>Main topics</b>		1) Scambio ERT tra i vari Partner per condividere le attività previste nelle diverse misure;		
		2) Rivedere i contenuti insieme, in modo da avere COERENZA nella descrizione delle misure;		
		3) Prevedere un rimando corretto e concordato in tutte le misure collegate (es. 02.02 e 02.03);		
		4) Coinvolgimento Bicimia (geom. Verità) per testare l'efficacia della distribuzione delle tessere OMNIBUS e il loro funzionamento per gestione P&R (verificare tracciabilità dei dati) e scegliere un Parcheggio + BICIMIA (x es. in centro), dove si hanno dati e uso della OMNIBUS		
		5) considerare solo timbrature e uso delle OMNIBUS (no altre carte!!!)		
		6) necessità di ricevere (dal CBS???) una tavola con la localizzazione dei Parcheggi per la Metropolitana e il numero degli stalli (deve essere base condivisa!!!)		
		7) usare modello di BSM come previsto nella M02.02		
		8) concentrarsi anche solo su uno scenario, Parcheggio e analizzarlo benissimo!!		
		9) portare dati e info al prossimo incontro (15 dicembre)		
		10) rendicontare questa attività nel Process Evaluation Form (Focus, coordinamento e condivisione)		
		11) vedere indicatori delle misure, in particolare quelli legati alla simulazione metropolitana e collaborare per la raccolta (usare modello della M02.02)		
		Prossimo incontro fissato per il 19 Dicembre 2011 a Brescia Mobilità		

Fig.A2.2: Focus Group activities – Convocation of the 1<sup>st</sup> meeting (15 November 2011)

		Brescia University	<b>FOCUS GROUP ACTIVITIES</b>	<b>CIVITAS MODERN</b>
<b>Title</b>		<b>Impostazione dei Focus Group</b>		
<b>Metro Package measures</b>		M02.02 Intermodality with public transport M02.03 Development and upgrade of the e-ticketing system M03.03 P&R facilities for underground and public transport system M08.05 Brescia Mobile Channel		
<b>Other stakeholders</b>		- Brescia Municipality - Sutura - Verità		
<b>MEETINGS</b>	<b>Partner</b>	<b>PRESENCE</b>		
Date: <b>19 dicembre 2011</b>	Brescia University	Bulferetti, Cadei, Ferrari		
	BSM	Sbardella, Gussago, Ragnoli, Pace		
	CBS	Bresciani		
<b>Main topics</b>	1) Verifica dello scambio dei dati di input per la coerenza degli scenari per i parcheggi; 2) inquadramento delle misure M02.03 e M08.05 (in qualità di possibili lighthouse measures) all'interno del Metro Package; 3) cronogramma della M02.03; 4) soluzioni trovate per la registrazione dell'utilizzo del servizio P&R per gli utenti occasionali (sistemi, fornitura, test); 5) determinazione e consapevolezza della capacità decisionale che il ML ha come responsabile della misura; 6) analisi della percezione di rischi/problematiche oltre Civitas; 7) definizione del ruolo del Mobility Manager all'interno del Focus Group 8) proposta dell'organizzazione di un Focus Group aperto al pubblico (individuando persone da coinvolgere) per avere opinioni e aspettative da parte dell'utenza in merito a bike sharing, parcheggi, BMC, ecc., da considerarsi come azione di dissemination			
	Prossimo incontro possibile: prima della riunione tecnica di febbraio			

Fig.A2.3: Focus Group activities – Convocation of the 2<sup>nd</sup> meeting (19 December 2011)