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.

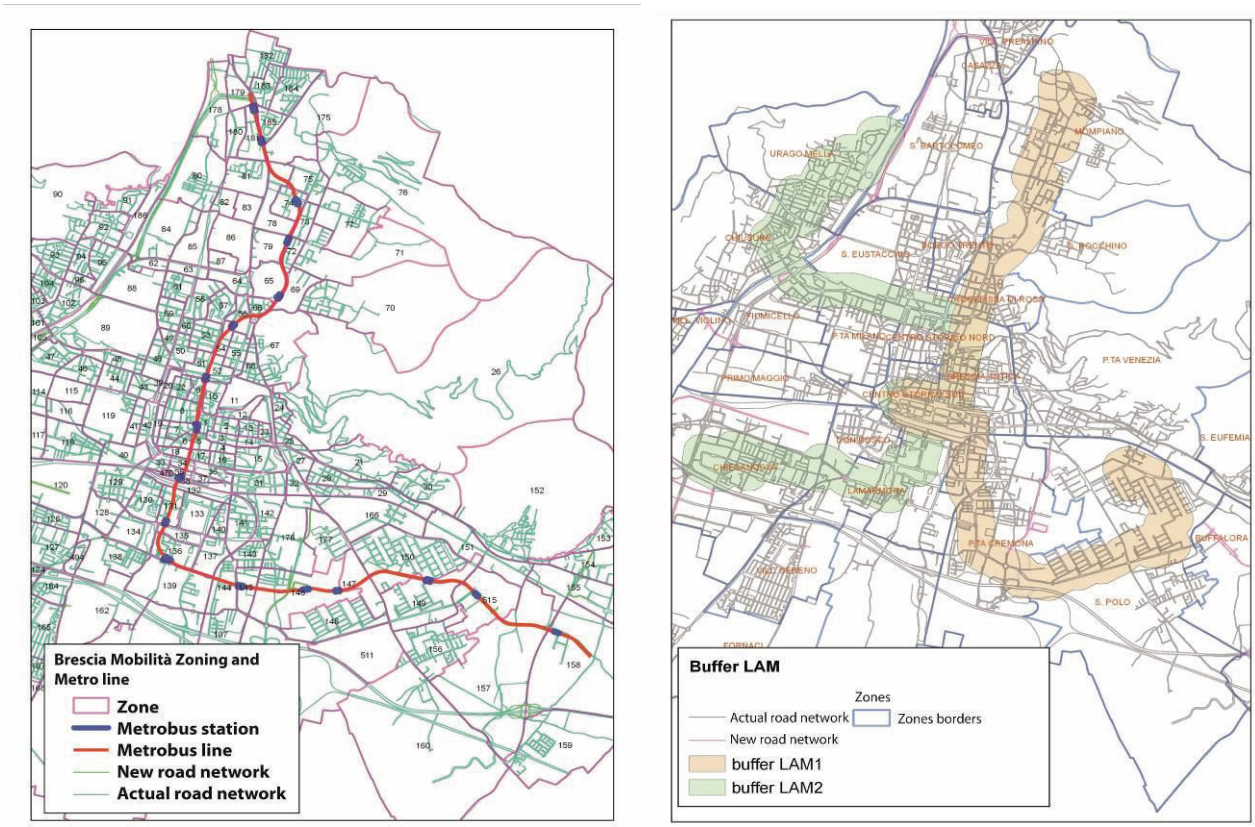

Fig.2-3: On the left, the new zoning of the city of Brescia used to build up different scenarios; on the right, the planned situation of the local PT characterized by the urban and suburban network

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 Dinasim. 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 shpos, 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.

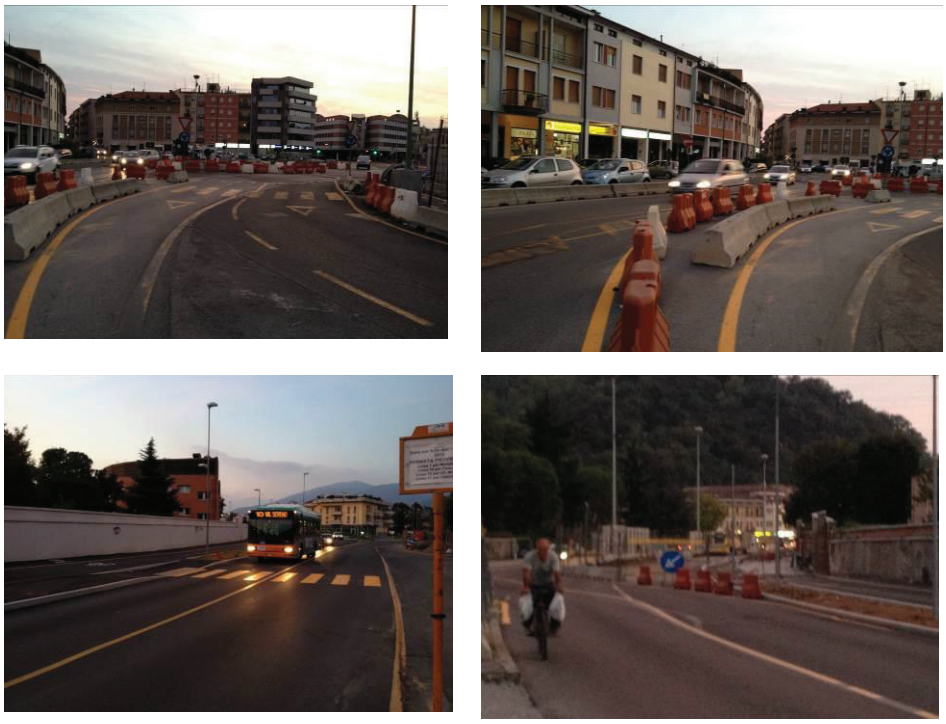

Fig.5 : Example of "Ospedale" metro station: reorganisation of the pedestrian paths and intersection

- **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.

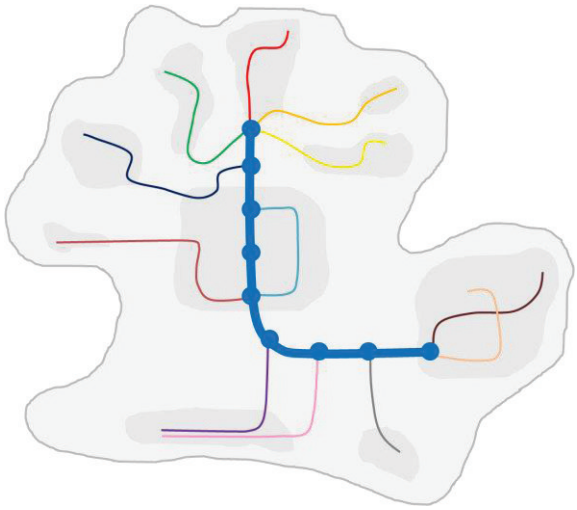

Fig. 6- Radial line PT network (Scenario K):

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

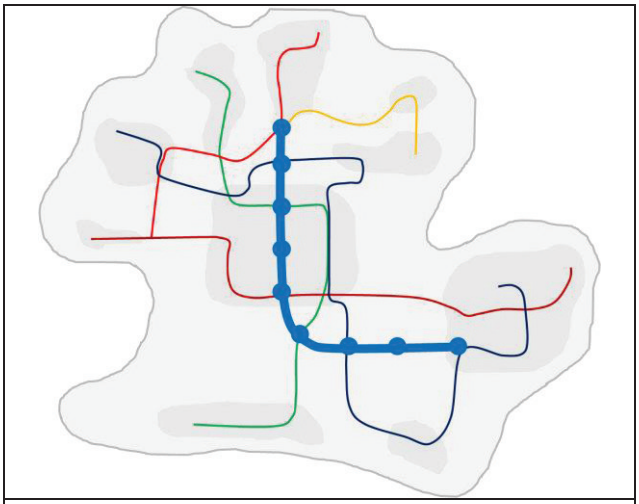

Fig. 7 - Diametric line PT network (Scenario B)

- 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),

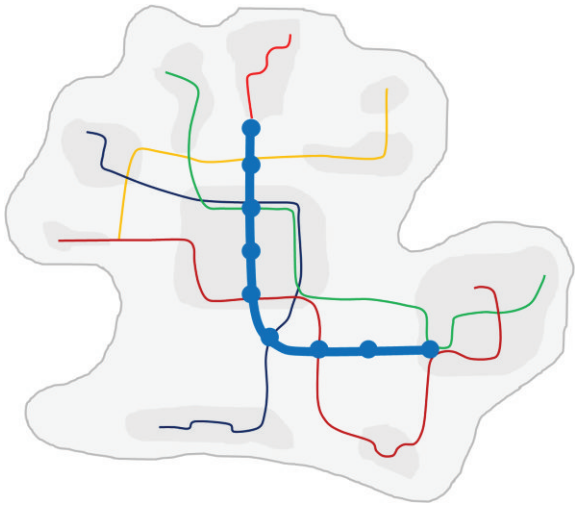

Fig. 8 - Diametric line PT network (Scenario B*)

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.

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

	comfort	Comfort	Satisfaction questionnaires.	

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.

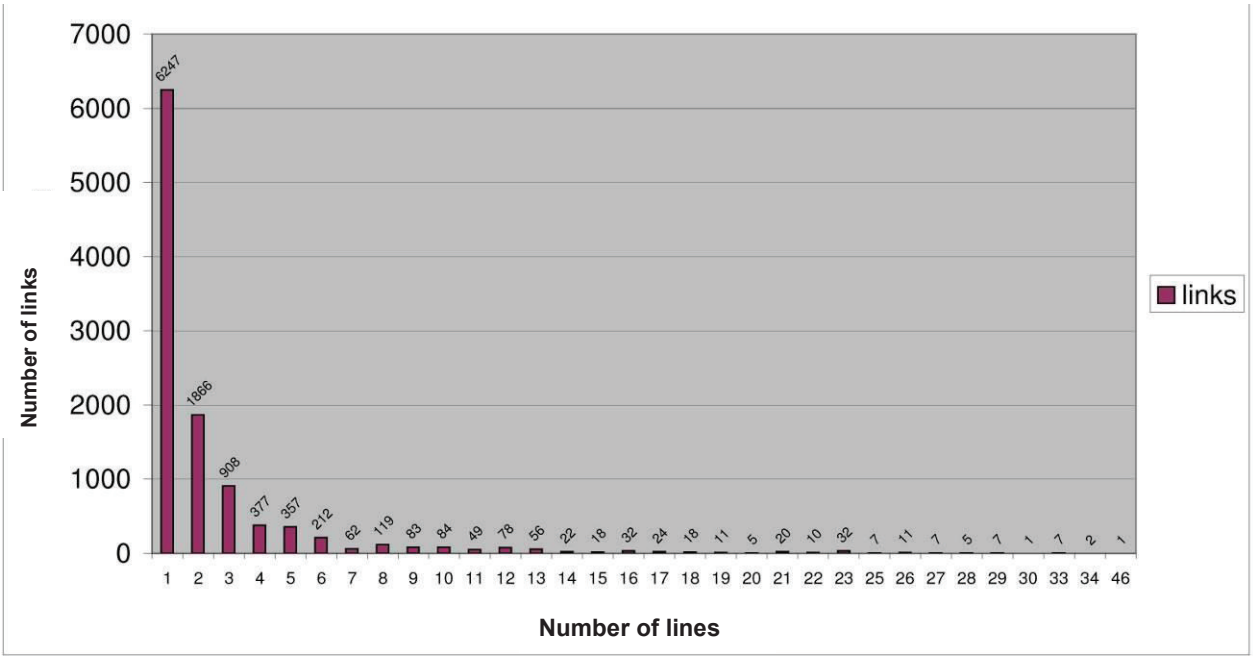

Fig.9: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

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.

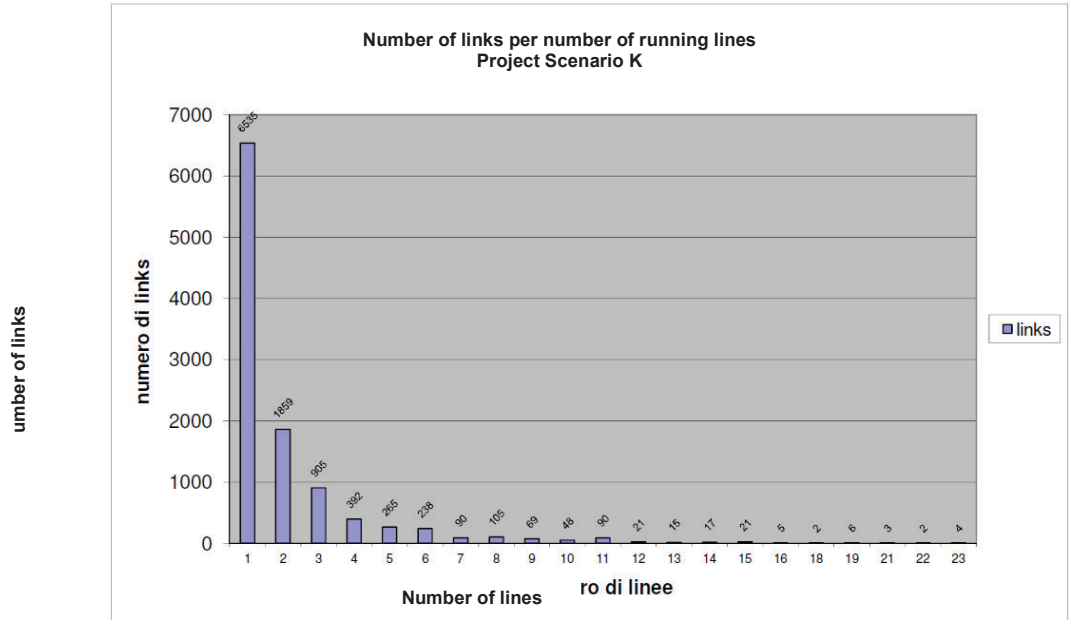

Fig.10: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

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)

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		

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).

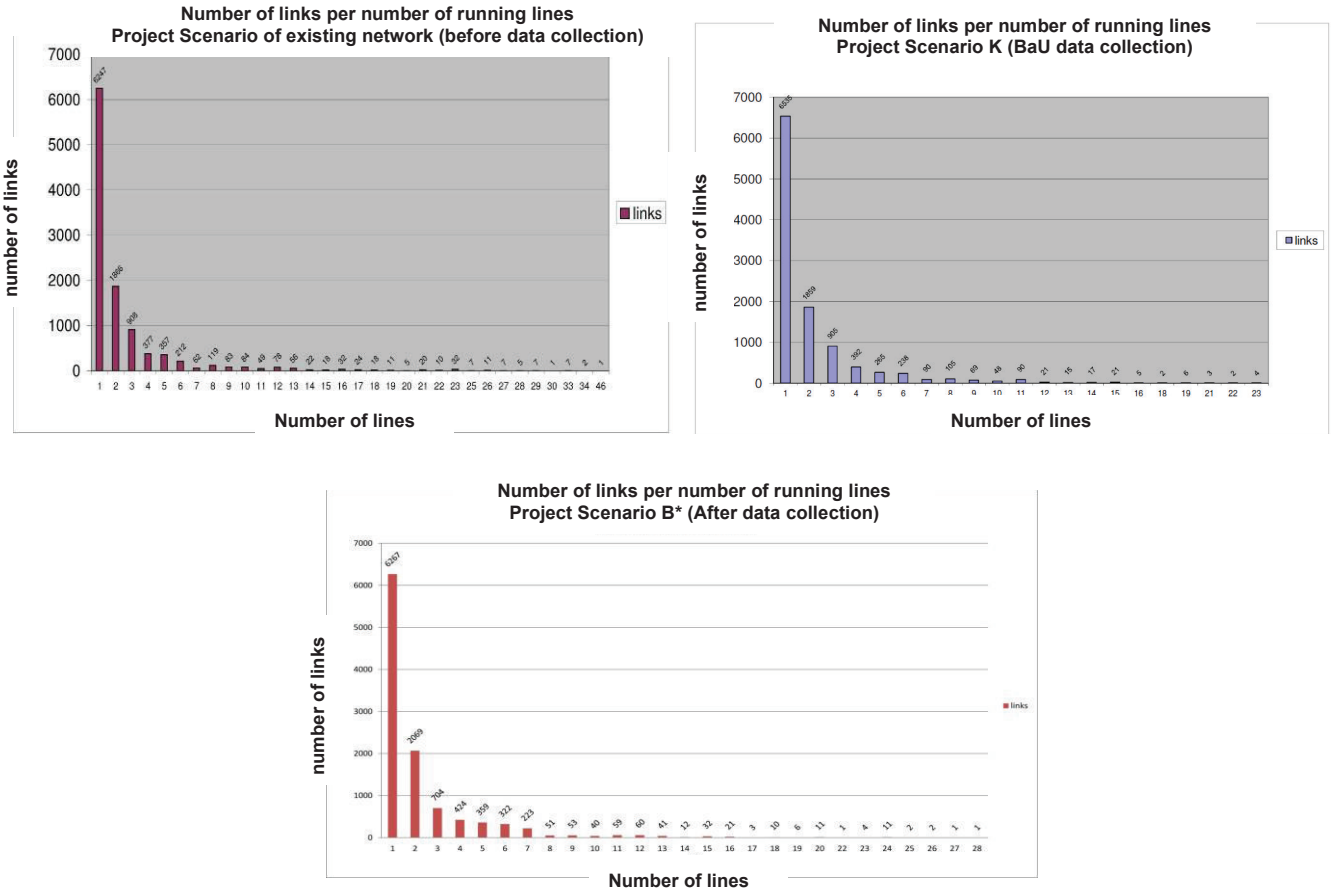

Fig.11-12-13:Comparison of number of overlapping PT lines on each road segment (links)

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

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	To carry out research, feasibility studies and demo activities before the start-up of the new Metro line foreseen by 2013. This objective can be considered achieved in full. Besides the simulation model referred to the existing PT network, 3 network scenarios including the metro line have been developed. 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.	**
NA = Not Assessed O = Not Achieved * = Substantially achieved (at least 50%) ** = Achieved in full * = Exceeded**		

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.

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%

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

	Ind. 8 Intermodal users comfort (concise judgement)
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%

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%

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%

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%

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%

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.

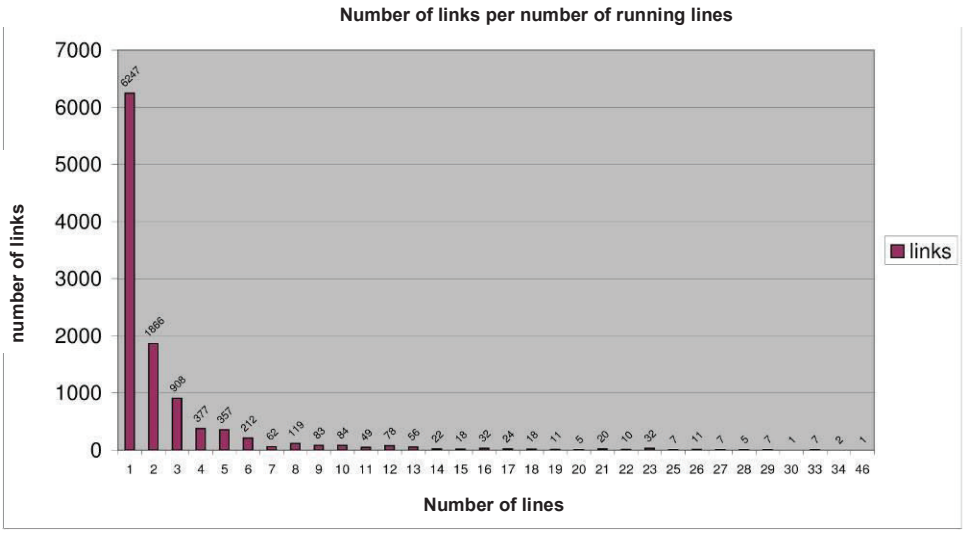

Fig. A2.1: Number of overlapping PT lines on each road segment (links) – Simulation of the existing network

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.

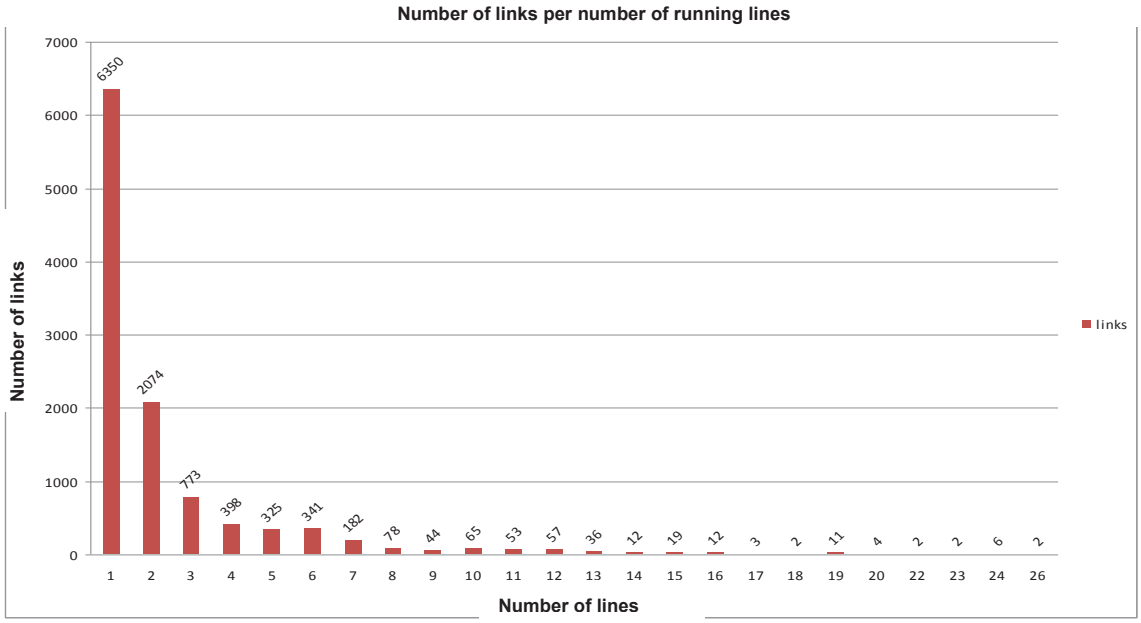

Fig. A2.2: Number of overlapping PT lines on each road segment (links) – Simulation of the B network scenario

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)

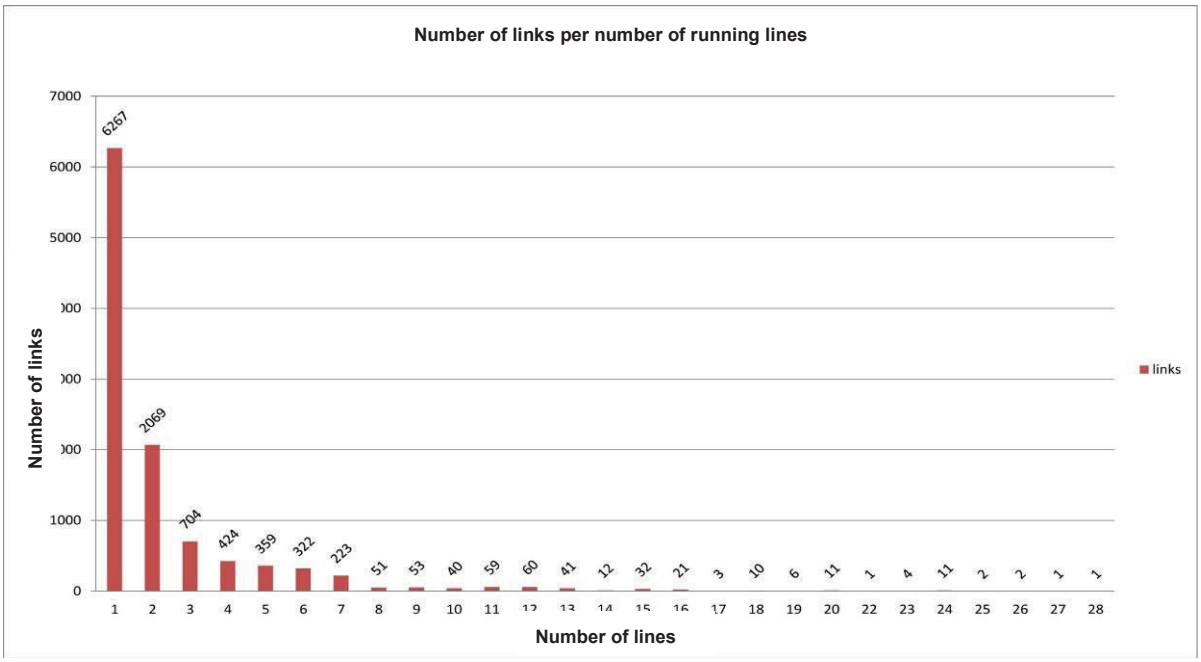

Fig. A2.3: Number of overlapping PT lines on each road segment (links) – Simulation of the B network scenario*

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 form 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.

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.

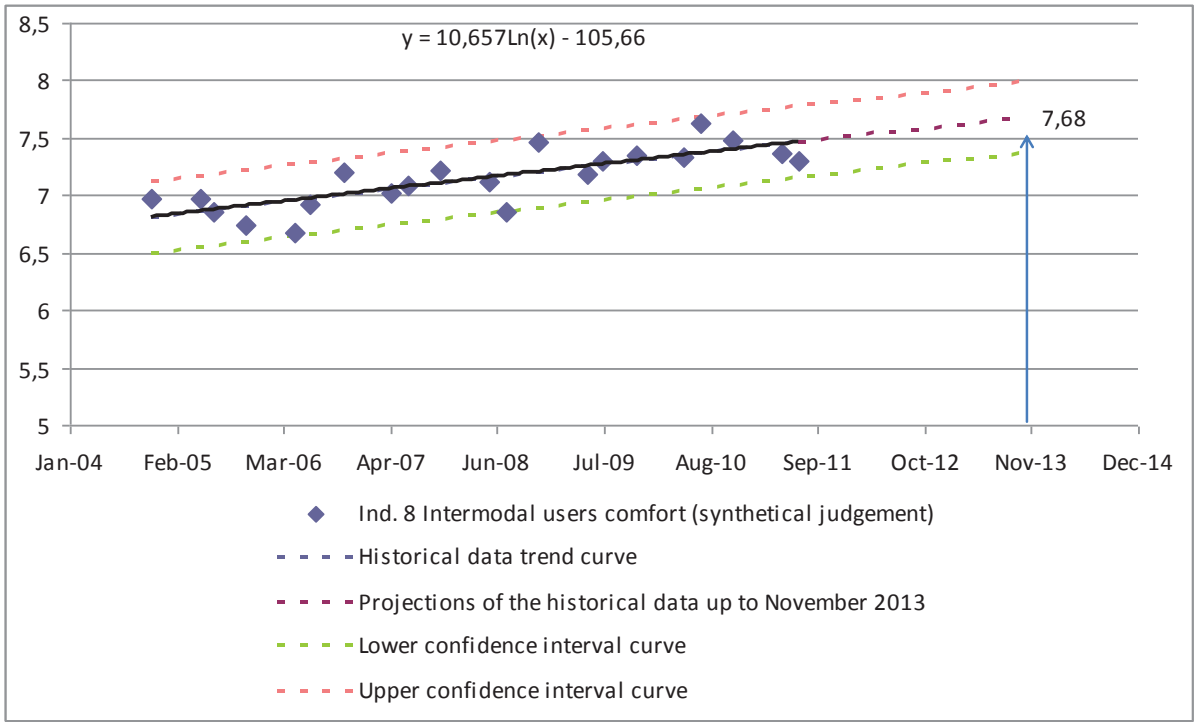

Fig. A2.4: Projection of the intermodal user comfort

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.

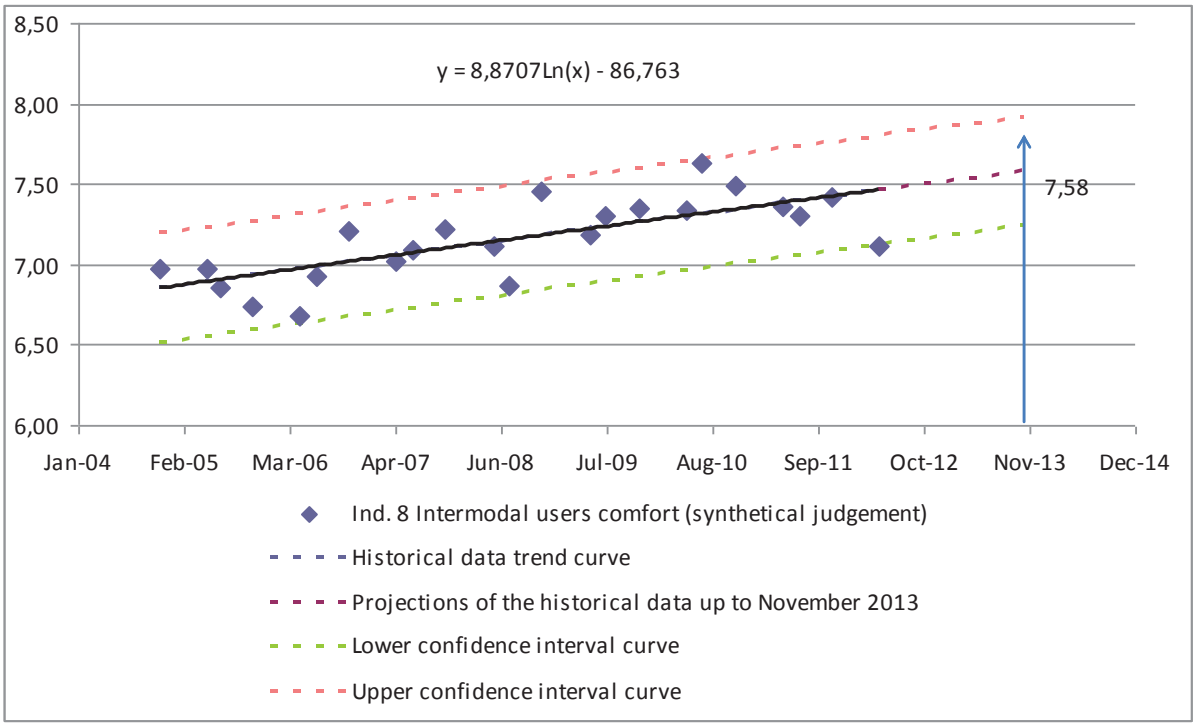

Fig. A2.5: Projection of the intermodal user comfort

ind. 8 = 7,58 / 10

Annex 3: Focus Group Activities

	Brescia University	FOCUS GROUP ACTIVITIES	CIVITAS MODERN

Title	**Impostazione dei Focus Group**
Metro Package measures	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
Other stakeholders	- Brescia Municipality - Sutera - Verità

STEP 1	**Accoglienza e riscaldamento (circa 10 minuti)**		
	1) Presentazione degli invitati al gruppo di discussione.		
	2) Presentazione dei ricercatori.		
STEP 2	**Introduzione al tema della discussione (circa 10 minuti)**		
	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.		
STEP 3	**Fasi della ricerca: descrittiva, riflessiva e propositiva**		
	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	**Verifica di fattibilità e scelta finale**		
STEP 5	**Assegnazione dei ruoli**		
STEP 6	**Sintesi dei risultati**: - per singola misura; - per Metro Package		

General structure of the Focus Group activities

	Brescia University	FOCUS GROUP ACTIVITIES	CIVITAS MODERN

Title	**Impostazione dei Focus Group**	
Metro Package measures	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	
Other stakeholders	- Brescia Municipality - Sutera - Verità	
MEETINGS	**Partner**	**PRESENCE**
Date: ***15 november 2011***	Brescia University	Bulferetti, Cadei, Ferrari
	BSM	Sbardella, Gussago, Ragnoli, Pace
	BST	Sutera
	CBS	Bresciani
	BICIMIA	Verità

Main topics	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

Focus Group activities – Convocation of the 1th meeting (15 November 2011)

	Brescia University	FOCUS GROUP ACTIVITIES	CIVITAS MODERN

Title	**Impostazione dei Focus Group**	
Metro Package measures	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	
Other stakeholders	- Brescia Municipality - Sutera - Verità	
MEETINGS	**Partner**	**PRESENCE**
Date: ***19 dicembre 2011***	Brescia University	Bulferetti, Cadei, Ferrari
	BSM	Sbardella, Gussago, Ragnoli, Pace
	CBS	Bresciani

Main topics	1) Verifica dello scambio dei dati di input per la coerenza degli secnari 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

Focus Group activities – Convocation of the 2nd 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.

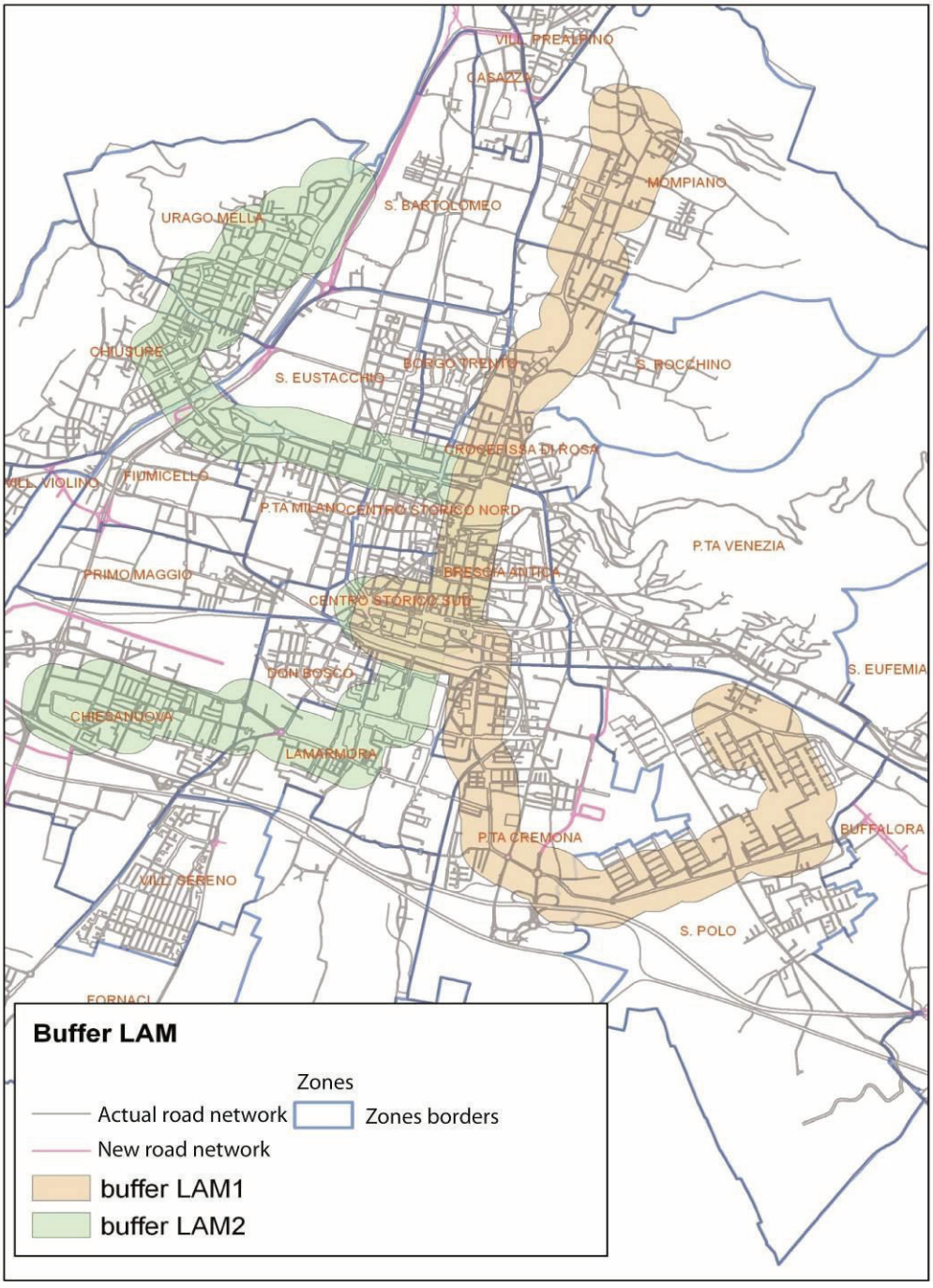

Fig.A4.1: Existing public transport system

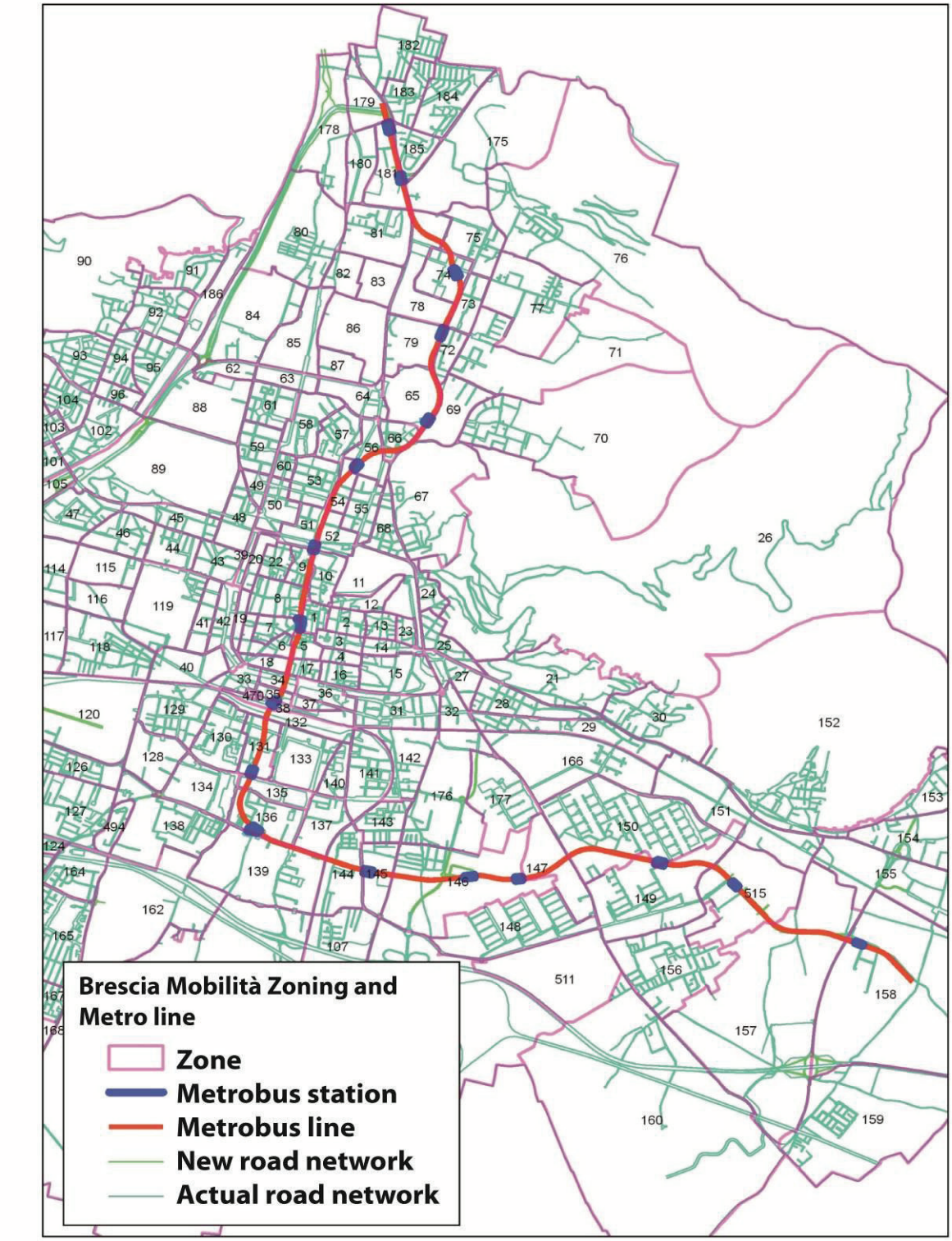

Fig.A4.2: New zoning of the city of Brescia used to build up different scenarios

- **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)**

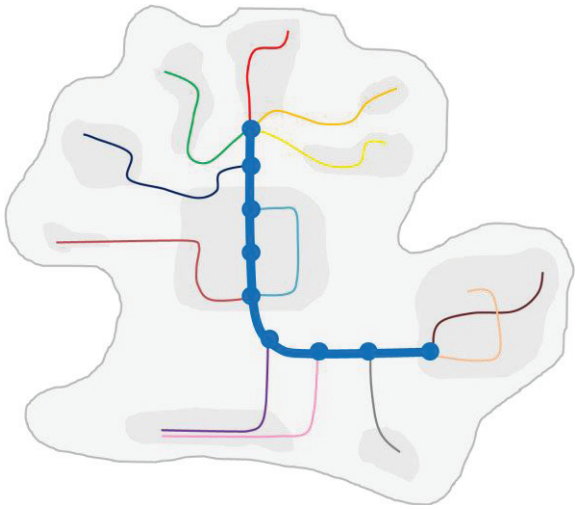

Fig. A4.3- Radial line PT network (Scenario K)

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)**

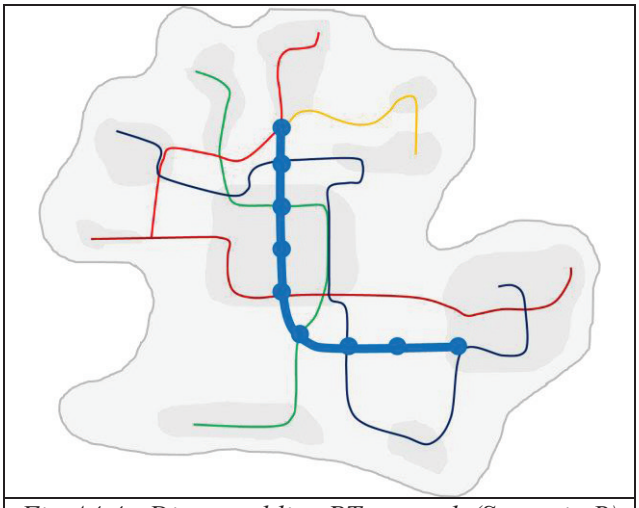

Fig.A4.4 - Diametral line PT network (Scenario B)

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)**

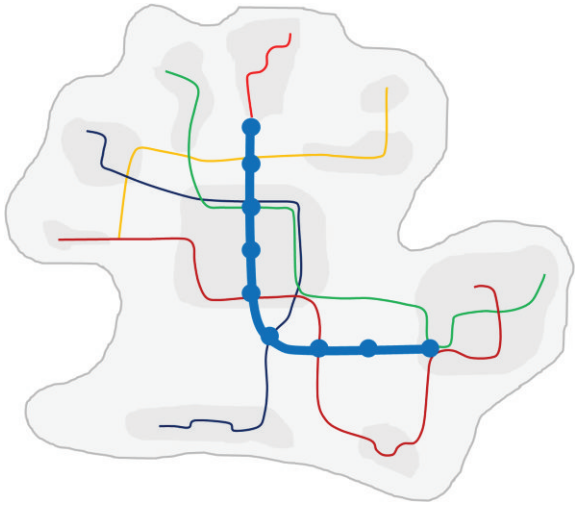

Fig. A4.5 - Diametric line PT network (Scenario B)*

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;

- 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.

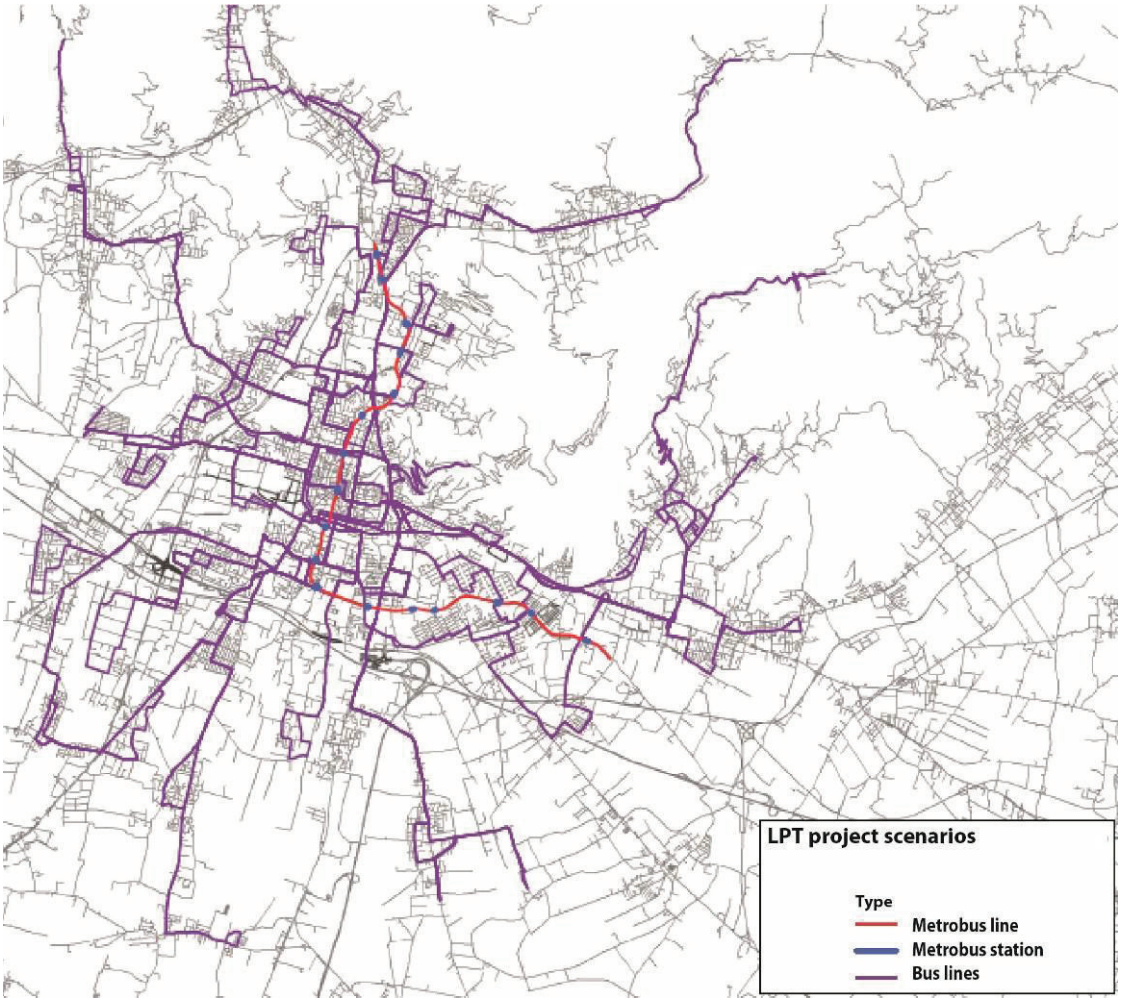

Fig. XXX Scenario B - July 2011*