

DELIVERABLE KEY INFORMATION	
Document Code	D8.3.3 (BOL) Report on CISIUM testing
Title of Document	Report on CISIUM testing
Reference Workpackage	WP8
Reference Measure	8.3
Contractual Date of Delivery	14.02.2012
Actual Date of Delivery	20.02.2012
Dissemination Level	PU
Date of Preparation	15.01.2012
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Context and Purpose

For traffic management activities, the Municipality of Bologna has developed Cisium, the new traffic control center, which connects and integrates the ITS systems in the city in order to achieve optimal real time traffic information and management.

Bologna Administration has performed the following tasks within measure 8.3:

- Better traffic light management with a global supervisor system, connected to Advanced Vehicle Monitoring (AVM) central of public transport, in order to guarantee the best prioritization for buses;
- Advanced real time traffic monitoring and modeling system that help technicians to better understand traffic conditions and to quickly respond and plan for improvement of circulation;
- Online dynamic travellers support information via Variable Message Signs, Internet, SMS, DATEX protocol to interface, etc. in order to reach the most of users and to individualize the best path/means of transport for citizens.

Thanks to these improvements, the traffic control center can now control a large part of traffic lights in the city and influence traffic communications in the whole metropolitan area. This new system has already been funded outside the Civitas program. In the context of Mimosa measure 8.3, dedicated to Cisium, a continue fine tuning activity on traffic models and scenarios, together with an evaluation analysis have been performed and are in progress, in order to improve both the

reactivity on real time traffic criticalities and the off line redefinition of traffic models and car flow management.

Purpose of the present Deliverable is to give a complete overview of the efforts undertaken by the Municipality of Bologna in Traffic monitoring and parameter tuning.

Summary Contents

Cisium (traffic control centre) main features:

Cisium system has been developed to improve the efficiency of the transportation system through the improvement of traffic control. Further objectives of the system are to provide citizens with real time traffic information and to improve traffic planning tools. The upgrade of the traffic control center added several innovative features such as the real time communications via the TMC protocol and other real time communication media.

The activities undertaken by the Municipality Administration have been mainly of two orders:

- **Traffic model and scenario analysis:** a detailed analysis has been produced, in order to study new traffic models and to define the traffic scenarios; statistical elaboration has been used to understand critical situations and to define a parameter tuning/calibration plan.
- **Traffic monitoring and parameter tuning:** following the results of the analysis, has been performed a continuous traffic monitoring of the critical situations and a detailed activity of scenario validation and calibration of traffic models. The entire real time traffic lights control platform has been continuously monitored and updated in order to reach the best optimisation according to the requirement and considering traffic evolutions. More detailed, the factors detected by static and mobile sensors (i.e. traffic flows, queues, turning flows, road capacities) that are used as input in the traffic light control platform, have been elaborated in the scenario classification and consequently have been realized the parameter tuning (red and green phasing of traffic lights, bus prioritization timing, information diffusion, etc.) aiming to the traffic optimizing.

To understand Cisium functioning, we sum up its main features/components:

- **Integration with other ITS systems in Bologna:** an Information Mobility Hub (IMH) collects information from other systems such as geo-referenced thematic traffic cartography, Limited Traffic Zone (LTZ) enforcement system, parking availability, etc.
- **MMS** Mobility Monitoring System: an automatic supervision system based on a traffic scenario classification and recognition, in order to identify critical situations
- **MCS** Mobility Control System: based on inputs provided by MMS, this module reacts to critical situation with area-control of traffic lights
- **DQI** Direct Query Interface: a “window” in the system, where operators can interact in order to recognise the condition and the diagnostic of the system and see statistical computations
- **RGS** Route Guidance System: Travel planner interface, considering different means of transport (in combination also) and real time traffic conditions. The

system collects traffic data from AVM (for bus information) and Utopia/Cisium (for private cars) platforms, assigning to each arc (road segment included between 2 crossroads) a coefficient describing traffic condition and updating this data every 5 minutes. The algorithm calculate the minimum path (in terms of travel time) or the best one (if it's convenient for you to choose a Park&Ride or Bike mode)

- **MMUI Multi Media User Interface:** a module that provides real time information towards external channels such as VMS (directly connected to the centre), local radio and satellite navigators (via the TMC Datex protocol), SMS, Web, email. The traffic information is diffused in an automatic way, for normal condition or automatically detected congestion.

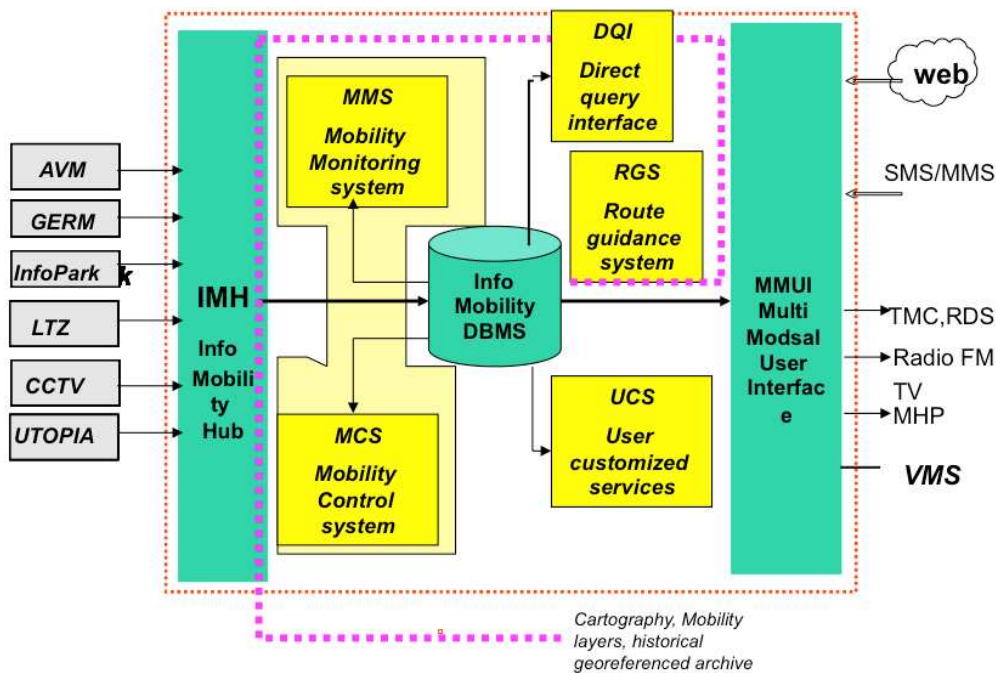


figure number 1 – Cisium features

The Cisium system is designed to accept queries about optimal routes (RGS module) and the general condition of the road network (MMS module). A FDMS platform performs this task, with general standard communication (TCP, XML).

Communication between the local spots and the centre are provided with several channels:

- ADSL for traffic lights
- ADSL for CCTV
- PSTN (telephone via modem), GSM or GPRS for VMS
- GPRS for tracking route for equipped vehicles and bus
- GPRS for a set of sensors not connected to traffic light, only for traffic detection

During Mimosa project, all minor bugs were solved and the accuracy of the algorithm has been proved before the implementation. In any case tuning of Cisium (traffic control centre) continues focussing in particular on:

- Writing of software for the exchange of data with Google Traffic;
- Configuration of GIS data in the urban traffic vector cartography;
- Integration of the software into the variable messages panel control;
- Check/tuning of correlation algorithm between private vehicles and public transport;
- Check/tuning of congestion detection algorithm;
- test of website;
- test of travel planner;
- Check of subsystem connections;
- Development of a new software for the detection of accidents and road works in progress in the traffic management algorithm;
- New web services implementation for the interconnection between the traffic control centre and other external systems

A new algorithm has been implemented in Cisium. The two main new features consist in:

- Modification of data provided by bus control centre: the new module is based on delays of a bus in relation to the timetable; the variation of delays per bus in each road gives information about congestion. These data have been classified into several thresholds that have been set and tuned according to information provided by ATC. This new module provides a 20% increase in information concerning the road network of the city.
- Modification of data provided by traffic lights: the new module is based on new traffic index provided by traffic lights. Instead of the queue index, which was previously used, we use now the delay index that consists in the average of vehicles waiting time at each traffic light. These data, after being set and tested, are now more accurate in the description of traffic phenomena, than the previous ones.

Thanks to this upgrade, Cisium is now able to provide information on more roads with an increased level of accuracy (tested with on road campaign).

The Municipality of Bologna makes a synthesis of these two index:

- if the information provided by the two index is the same this is considered valid (Contemporary use);
- if they don't agree they need to be validated;
- if there is only one index the information provided by this index is used (Alternative use)

In this context, an important activity undertaken by the Administration, together with ATC, is an action of data testing and crossing from different sources and a work of control of the accuracy of the static geo-referenced data, which means:

- from the side of the first index, the control of the accuracy of the information on bus stops locations;
- from the side of the second index, the control of the accuracy of the information on traffic lights locations and on the algorithm functioning rules;

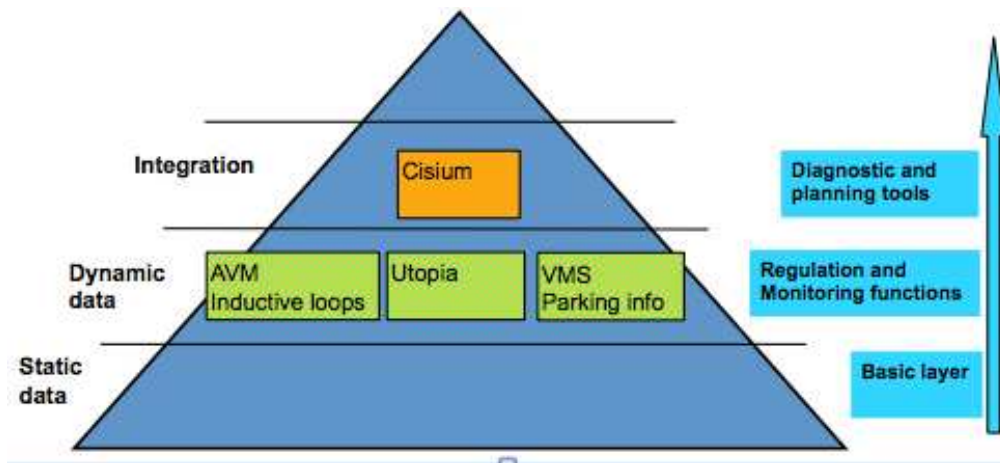


figure number 2 – integration of static and dynamic data through Cisium algorithm

Furthermore, the algorithm that regulates Cisium allows to make the same control on the two sources of data in real time (every 5 minutes). Therefore the system can count on a real time validation of the data (traffic flows, variation of buses delays at the bus stops). These two controls take to the validation of a **Global Congestion Index** in the areas covered by the sensors installed by the Administration.

All this information can be found on Cisium website (cisium.webhop.net):

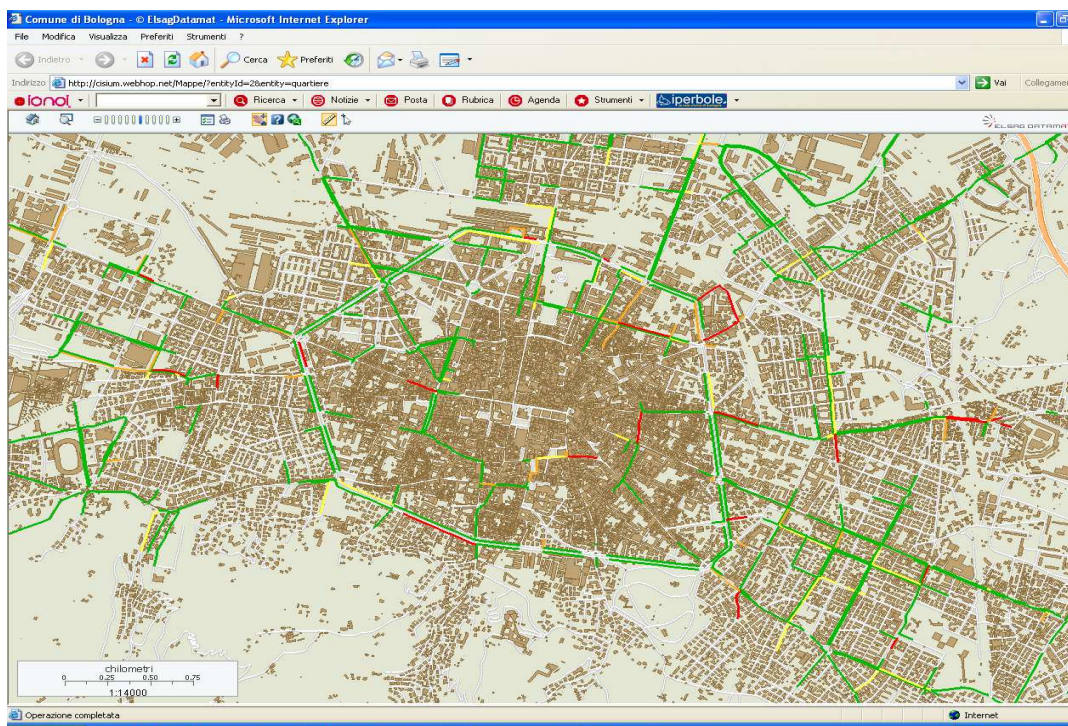


figure number 3 – Cisium website interface

where green colour means “few traffic”, yellow means “medium traffic” and red means “congestion”.

On the website is also possible to see where the road works are located. This is important because also the Travel Planner can take advantage of this information, which is integrated with Cisium (the Route Guidance System guides the Travel Planner).

Thanks to the MMUI (Modul Multi Media User Interface), is also possible to see the traffic situation in the city or to access to customised services (via web, sms, email), having subscribed a free access and indicating the zone/path of interest. Satellite navigators as well as the local radio information run using the DATEX protocol, that maps point of relevance (geographical points in the city that localise the information) and events (mapped in the protocol); the user end-point (satellite navigator or other traffic centre) is able to decode information and to diffuse it.

CISIUM

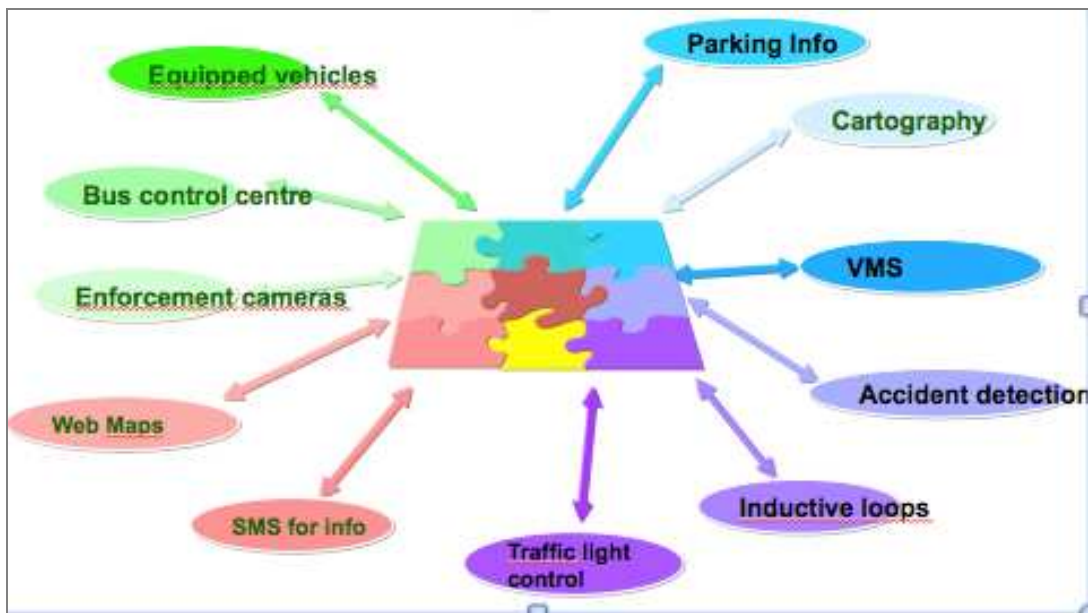


figure number 4 – Cisium as an integrated system able to collect data, analyse problems and elaborate strategies in order to decrease congestion, inform citizens in real time e provide tools for traffic planning

Thanks to this upgrade, Cisium is now able to provide information on more roads with an increased level of accuracy (tested with on road campaign). After the described upgrade, the Municipality of Bologna was able to sign two important agreements, one with Google and one with Bologna Airport, to enrich the real time information available for citizens.

In particular:

- Bologna subscribed to an agreement with Google in order to provide traffic data that are now published on Google traffic service; Bologna is the first city in Italy providing this service. Thanks to this agreement, real time information on Bologna's status of traffic congestion are provided by Cisium (the new traffic control centre) to Google and are available online for citizens.
- Thanks to an agreement signed with Bologna Airport, traffic information and information on the presence of road works in the city, are provided at the arrival

terminal of the Airport on informative panels, through a communication based on Tmc protocol.

- Furthermore, the same “open data protocol” has been used to plan the goods distribution route guidance in order to avoid road works (connection with Measure 7.1 Van Sharing).

During the last reporting period of Mimosa (PPR3), a public bid for the development of a third congestion indicator has been awarded, outside MIMOSA, in the framework of the Italian project Simone. This new indicator will be based on the floating car data (FCD), that are measurements of the average travelling times produced by vehicles with on board boxes for telemetric measurements. It will be tested the spread of the data through a communication based on Tmc protocol of the vehicles.

Functional Use

The purpose of the present Deliverable is to give a complete overview of the efforts undertaken by the Municipality of Bologna in Traffic monitoring and parameter tuning: a continuous traffic monitoring of the critical situations and a detailed activity of scenario validation and calibration of traffic models has been carried out by the Administration. The entire real time traffic lights control platform has been continuously monitored and updated in order to reach the best optimisation according to the requirement and considering traffic evolutions.

Lessons learned

The Municipality of Bologna, after Cisium algorithm improvement, can now take advantage of an open system that can be used to dialogue with different systems, providing real time information on traffic status (please refer to the agreements signed with Google Traffic and Bologna Airport and to the use done in connection of Measure 7.1 on Van Sharing). Cisium is now an open and integrated system able to collect data, analyse problems and elaborate strategies in order to decrease congestion, inform citizens in real time e provide tools for traffic planning.

Attachment

None

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