
Città di Bolzano
Stadt Bozen
TiS
innovation park
AIT
AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY
Life
inTegreen
Jenesien
Integration of Traffic and Environmental data for improving green policies in the city of Bolzano
Bozen - Bolzano
Second project workshop
24/06/2014

INTEGREEN: motivations & objectives

The reason why

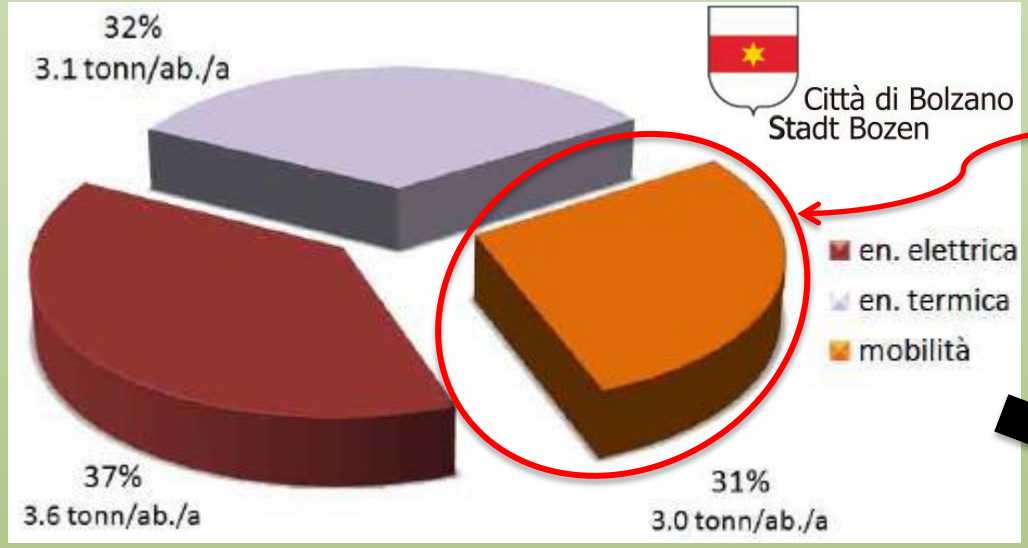
Seasonal traffic flows peaks from ext. centroids

[Source: transkom.com]

Environmental impact produced by urban traffic

INTEGREEN: motivations & objectives

The long-term perspective on greenhouse gas emissions



[Fonte: "Calcolo e valutazione delle emissioni di CO_2 e definizione di scenari di riduzione per la città di Bolzano", studio EURAC commissionato dal Comune di Bolzano, 2010]

By addressing the above challenges, it is possible to reduce the contributions related to this emission source

Target:
Reduce the CO_2 emissions from 9.7 to 2.0 [tons/inhabitant*year] before 2020

INTEGREEN: motivations & objectives

Can ITS contribute to CO_2 emissions reduction?

Intervention class	Domain	CO_2 reduction potential
Assisted urban navigation and improved **pre-trip / en-route travel information**	Microscopic	3-7%
Adaptive urban traffic control	Macroscopic	4-8%
Improved **eco-driving on-board**	Microscopic	3-5%

[Source: "L'impatto degli ITS per la riduzione di CO_2", TTS italia, 2010]

Integrated approaches can determine reductions up to 20-30%.
Air pollutants can be reduced with the same order of magnitude.
Next-generation traffic management policies (e.g «pay-as-you-drive») based on rewarding schemes could take full advantage of this potential.

INTEGREEN: motivations & objectives

The INTEGREEN project

Technological dimension:

- «Environmental» traffic management demonstration
- Enhanced traffic / air pollution monitoring system
- Environmental-oriented traffic policies testing (with impact assessment)

Social component:

- Awareness-raising about environmentally-travelling and driving for smart multi-modality

EU component:

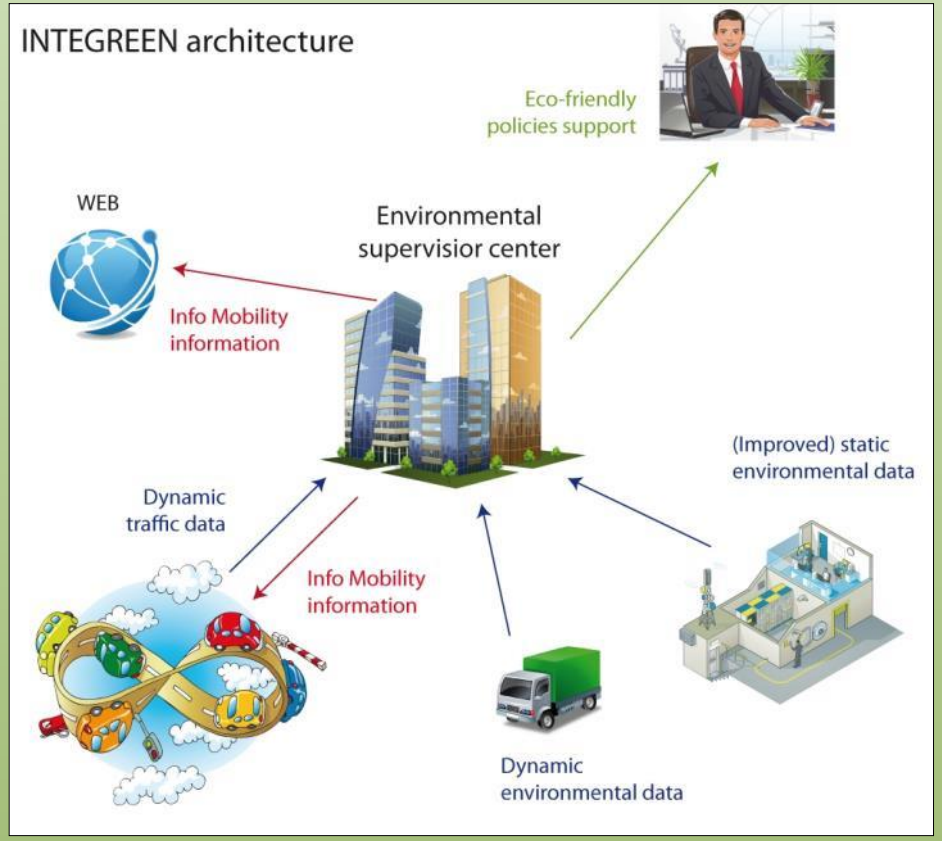
- Share INTEGREEN as a «environmental» traffic management best-practice

Project duration: 01/09/2011- 28/02/2015

Project budget: 1.311.810 € (ca 46,8% LIFE+ contribution)

INTEGREEN: motivations & objectives

The INTEGREEN project



From a technical point of view, the novelty if INTEGREEN is the combined use of **fixed stations** and **probe vehicles** for the detection of **traffic and air pollution levels**.

Mobile air pollution measurements is the most challenging part of the project (covered by AIT).

INTEGREEN: motivations & objectives

The INTEGREEN project

The hypothesis to be demonstrated:

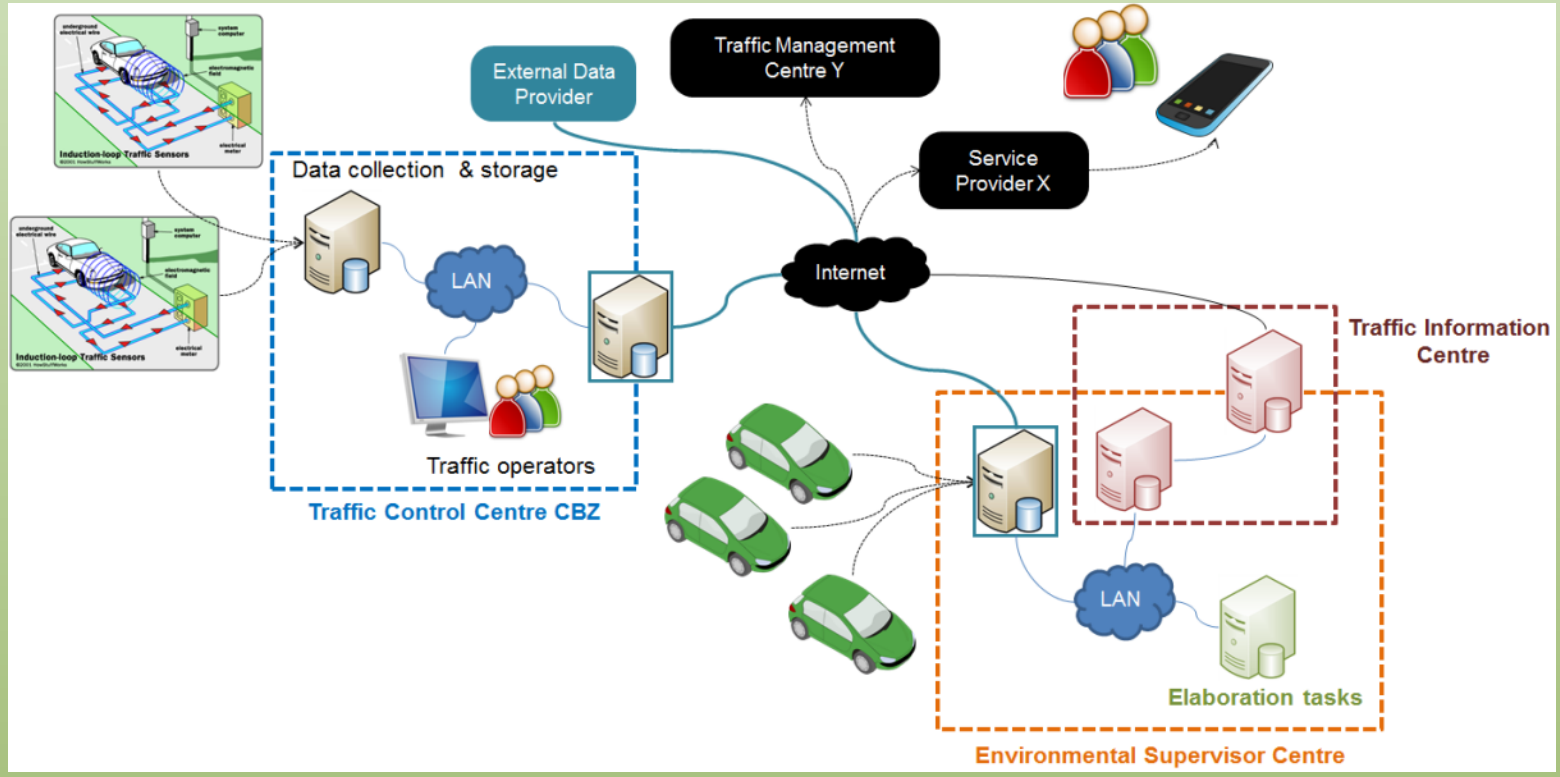
Can «soft measures» together with targeted awareness-raising activities contribute to relevant reductions of greenhouse gas emissions and air pollutants levels, withouth significantly limiting the mobility of people and goods in the city?

An **integrated ITS** system to measure it, on a real-time basis.

The integration is double: fixed / mobile probes; traffic / air pollution conditions.

Technical progress overview

High-level system implementation



Technical progress overview

A reference architecture for EU cities

- **EU added value of INTEGREEN**: provide a reference standardized architecture that other urban areas could follow to replicate the proposed approach
- **Reference architecture for CBZ to be used in order to extend its capabilities.**

Mapping of INTEGREEN into the **FRAME architecture**. FRAME is the reference ITS architecture development toolkit introduced through different EU project with the intention to promote harmonized ITS deployments.

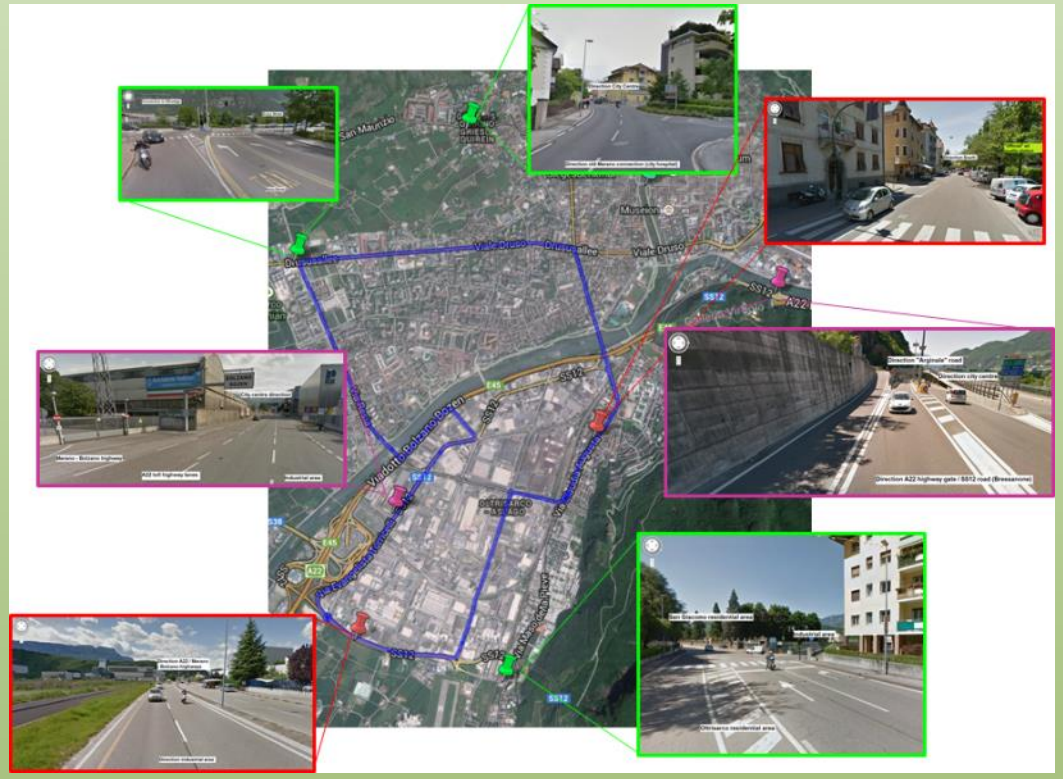
Technical progress overview

Additional data stored by the INTEGREEN Supervisor Center

- **Traffic Station Data Source**: in charge of the real-time collection of **traffic data** (inductive loops or alternative technologies)
- **Environmental Station and Weather Data Source**: in charge of the real-time collection of **air pollution and meteorological data**
- **Origin / Destination Data Source**: capable to collect information about current **vehicular travel times** on specific road links.
- **Vehicle Data Source**: in charge of the real-time collection of **traffic and air pollution measurements** collected by the **mobile probes**

Technical progress overview

Traffic detection points

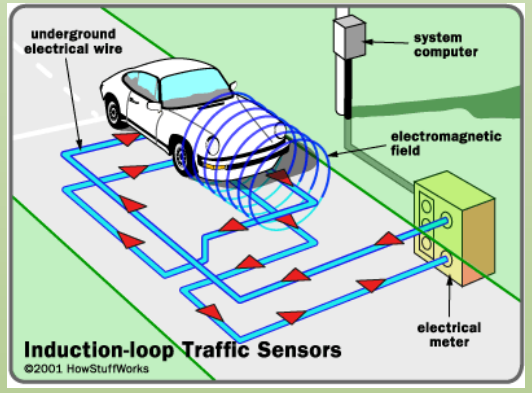


- **Green points**: existing detection points, to be repaired and with improved remote connection.
- **Pink points**: existing detection points.
- **Red points**: integrated traffic / air pollution detection points.

The system will include a connection to an automatic bicycle counter detection system.

Technical progress overview

Traffic monitoring stations details



- Traffic detectors will be traditional **inductive loops** (still the most reliable method in urban environments).

- Remote data management unit will be product **MROAD 500** of Famas System.

Capability to handle data from both traffic and environmental sensors.

Technical progress overview

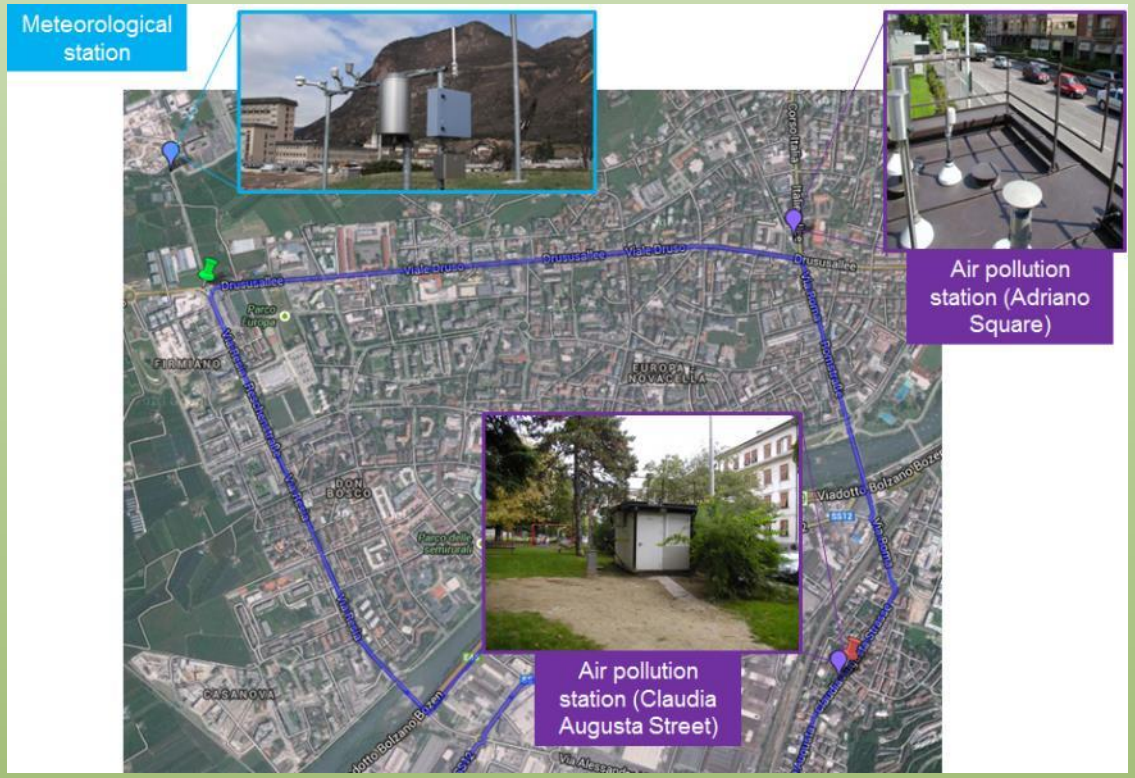
Roadside air pollution monitoring stations (1/2)

- ❑ Thick film semiconductor-based sensors
- ❑ PM detectors based on light scattering technology

- Same technology is mounted on the **mobile system** as well.
- **Easy deployment**, possibility to change installation location based on testing activities requirements.

Technical progress overview

Roadside air pollution monitoring stations (2/2) - existing air pollution and meteorological stations

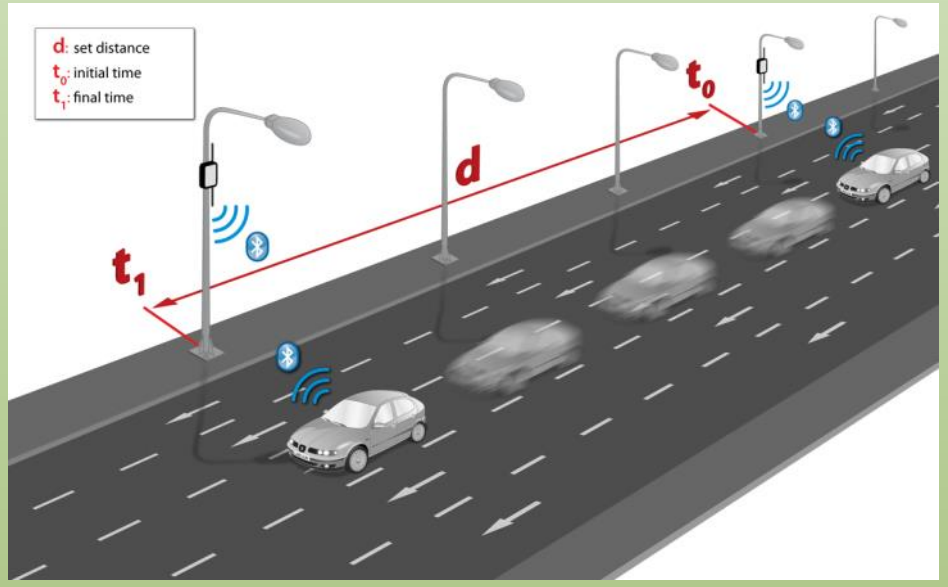


- **Air pollution** data from **BZ4** (Claudia Augusta Street) and **BZ5** (Adriano Square) stations: owner **Local Agency for the Environment**
- **Meteorological** data from BZ meteorological station: owner **Hydrografic Office Province BZ**

Technical progress overview

Vehicular travel times detection system

- **Environmental impact of traffic** is directly related not only to the **number of vehicles**, but also on the way traffic is flowing (e.g. speed).
- **Speed** information is not always available: vehicles are typically just counted...



Souce: Libelium

How to take in right consideration **congestion phenomena**?

Bluetooth based systems are low-cost solutions that could fill this gap.

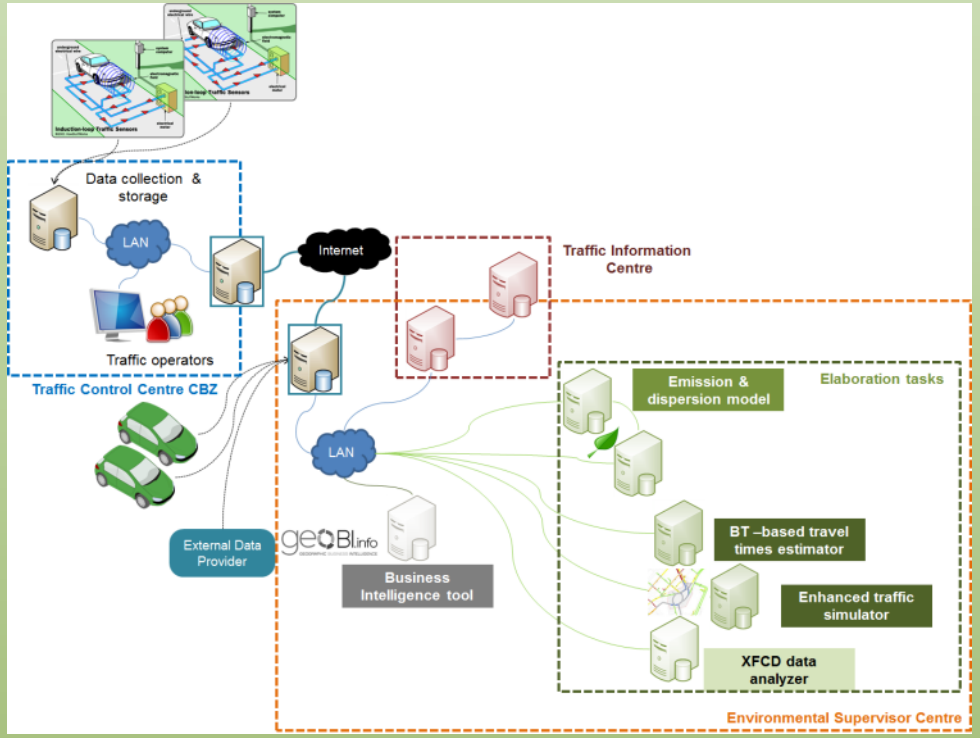
Technical progress overview

Vehicular travel times detection system

- 9 stations, 10 road links wil be monitored
- **Data stored**: anonymized identifier and timestamp.
- Direct connection to Supervisor Centre through VPN

Technical progress overview

Elaboration tasks

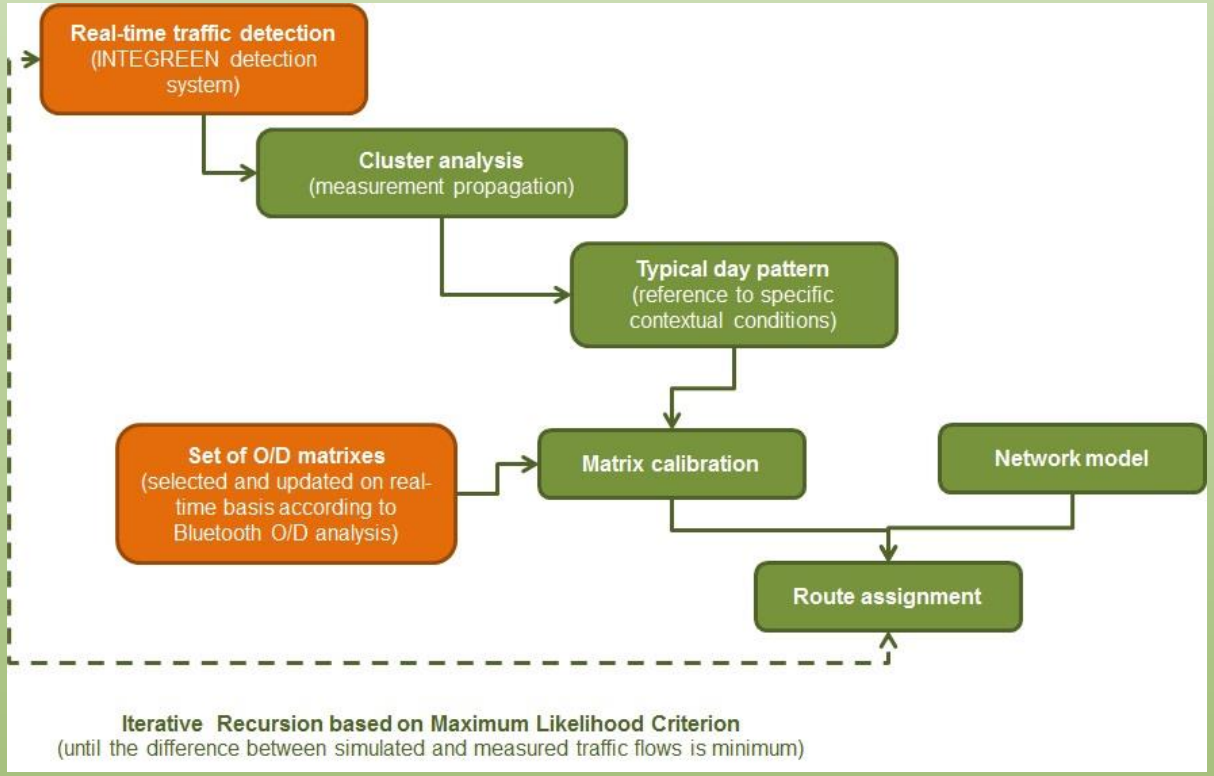


Automatic routines needed in order to compute on a real-time basis the traffic and environmental conditions in the city:

- **Bluetooth-based travel times estimator**
- **Enhanced traffic simulator**
- **Emission and dispersion model**
- **XFCD data analyzer**

Technical progress overview

Enhanced traffic simulator

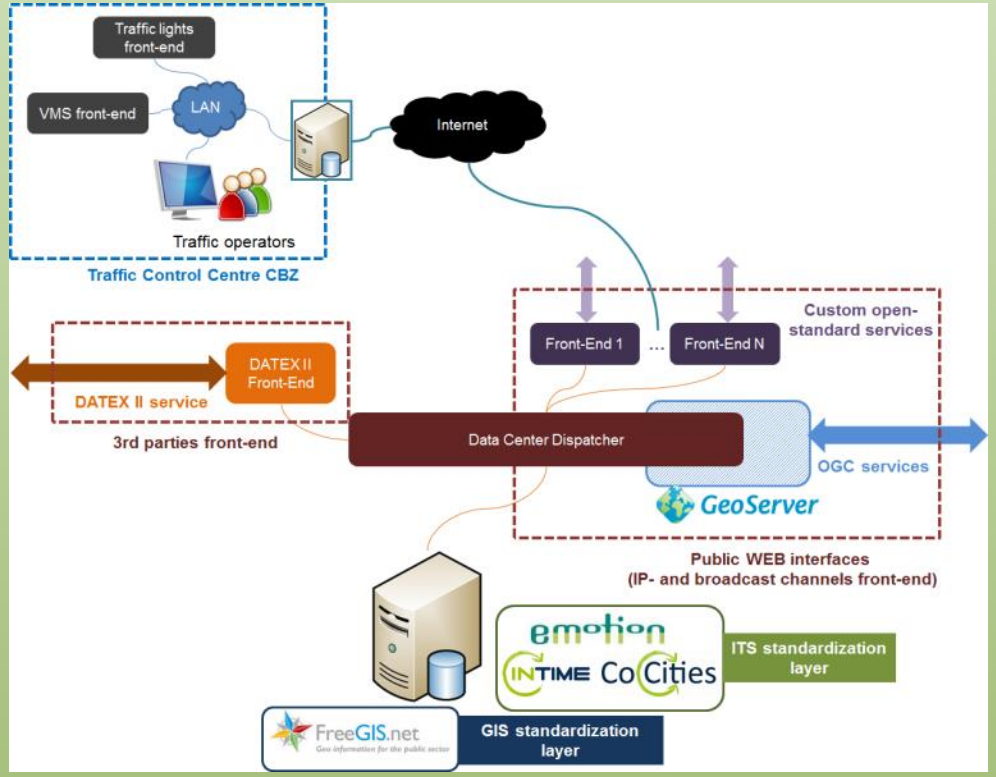


In INTEGREEN, the available offline **traffic simulation** will evolve to a «**semi-online**» model.

Traffic flows dynamically calculated based on **traffic data** and indications on **O/D matrixes fluctuations** provided by **Bluetooth** system.

Technical progress overview

Front-End Layer Architecture



- **OGC services**
- **Custom open-standard services**
- **DATEX II front-end**

A set of services that could address the different needs of different external actors, easily scalable once more data and information will be available.

Technical progress overview

Field Operational Tests

- **Local stakeholders involvement activities have created the premises for an extension of the final testing activities.**

Partners have decided not to buy dedicated demo vehicles, but to install the on-board units prototypes on existing vehicles that continuously circulate in the city (public transportation, car sharing, taxis)

With SASA, the urban PT operator, there is the willing to combine **macroscopic measures** defined by traffic operators with **microscopic measures** – improved eco-driving behavior.

Technical progress overview

Field Operational Tests

Intervention class	Domain	CO_2 reduction potential
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Adaptive urban traffic control	Macroscopic	4-8%
Improved **eco-driving on-board**	Microscopic	3-5%

It would be possible to make very specific evaluation of the contribution of each type of intervention and assess their joint combination.

Technical progress overview

Field Operational Tests

- **Outdoor urban test organization**

  - **Test site phase**. Verification of the proper fulfilment of most of the use case scenarios proposed in the requirements analysis.

ID	Use case	Trip phase	Reference User
UC_1	Local travelers getting information for an eco-trip	Pre-trip	Local travelers
UC_2	Local fleet managers getting information for an eco-trip	Pre-trip	Local transport planners
UC_3	En-route driver information through VMS	En-route	Local travelers
UC_4	En-route driver information on-board demonstrator	En-route	Mobile probes drivers
UC_5	Traffic and environmental status assessment: INTEGRATED MONITORING	Pre-trip / En-route	Traffic officers / engineers
UC_6	Traffic controllers adaptive coordination: ACTUATION	Pre-trip / En-route	Traffic officers / engineers

Technical progress overview

Field Operational Tests

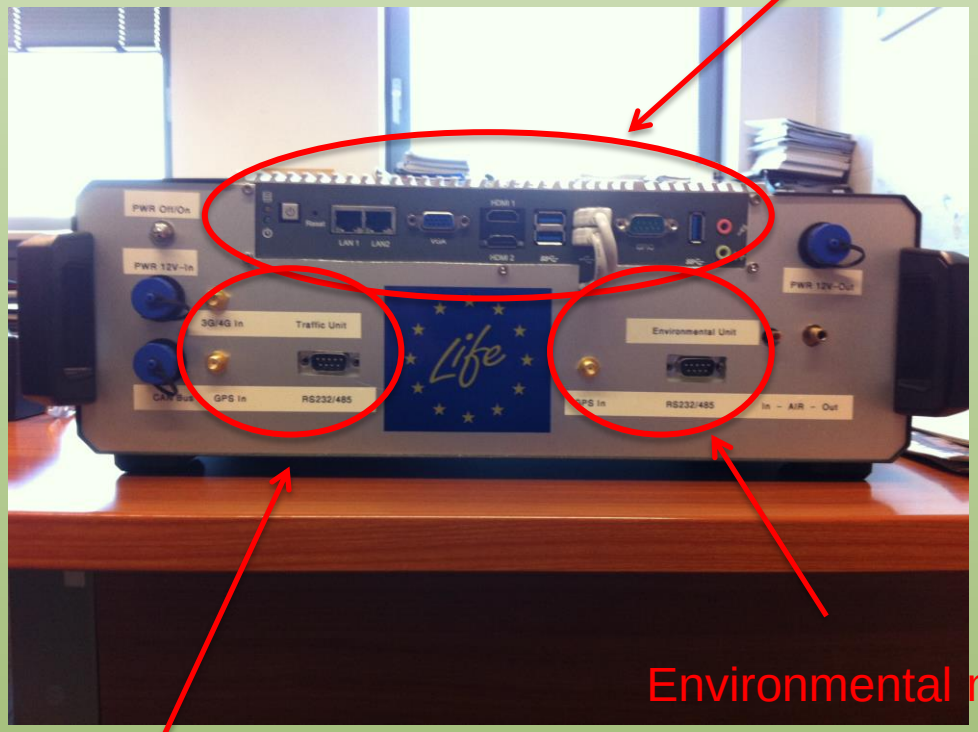
- **Outdoor urban test organization**
  - ❑ **Validation phase**. Field verification of the ecological benefits of experimental mobility and traffic strategies.
    - **Initial stage**: separated macroscopic strategies, with traffic operators. Mobile systems on car sharing vehicles driven by project staff.
    - **Final stage**: inclusion of microscopic improvements. Mobile systems on PT vehicles driven by professional drivers («naturalistic driving studies»).

Reference methodology: FESTA (guidelines for ITS Field Operational Tests in Europe).

Technical progress overview

Field Operational Tests

Telematic unit interface



Environmental monitoring unit interface

Traffic monitoring unit interface

Technical progress overview

Field Operational Tests

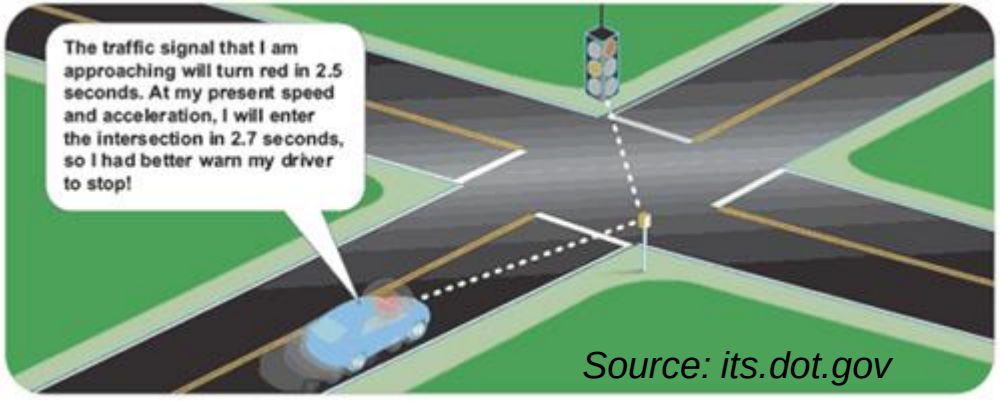
The idea is to install one (or two) mobile units on-board of the **SASA buses**, in order to collect a very large set of XFCD.

The plan is to focus the tests on **line 10**, which is the one that betters covers the city in space and time.

Technical progress overview

Final impact assessment & eco-friendly traffic policies evalation

- Final evaluation of field sessions
- Identification of **most effective approaches**
- Evaluation of **potential for future improvements**, even with more automatic routines (e.g. traffic light cycles adapting on the base of the traffic / environmental conditions assessed by the INTEGREEN system) and in direction cooperative scenarios



Source: its.dot.gov

E.g. *Energy Efficient Intersection* (EEI) UC