INFRAMIX

Road Infrastructure ready for mixed vehicle traffic flows

austriatech

SIEMENS
Ingenuity for life

ΕΠΙΣΕΥ ICCS

virtual vehicle

TECHNICAL UNIVERSITY OF CRETE

ASFINAG

autopistas
an Abertis company

enide

Fraunhofer FOKUS

TOMTOM

BMW

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INFRAMIX project - overview

INFRAMIX main target is to **design**, **upgrade**, **adapt** and **test** (in simulation and in real-world) both **physical** and **digital** elements of the **road infrastructure**, to enable the coexistence of automated and conventional vehicles, ensuring an **uninterrupted**, **predictable**, **safe** and **efficient** traffic.

The key outcome will be a **"hybrid" road infrastructure** able to handle **the transition period** and become the basis for **future automated transport systems.**

INFRAMIX objectives

- Design new and upgrade existing **physical** & **digital road infrastructure elements**
- Design **novel signaling** and **visualization elements**
- Design and implement **novel traffic estimation**, **monitoring** and **control strategies**
- Develop a **co-simulation environment**
- Develop **hybrid testing system**
- **Evaluate user's appreciation** and **acceptance**
- Evaluate **traffic safety**
- Create a **Road Infrastructure Classification Scheme**

INFRAMIX project facts

Duration: *1 June 2017-31 May 2020*

EC Funding: *5M €*

Coordinator:*AustriaTech*

Consortium:

Austriatech, ICCS,

Asfinag, Fraunhofer, Siemens,

Virtual Vehicle, Autopistas,

Enide,Technical University of Crete,

TomTom, BMW

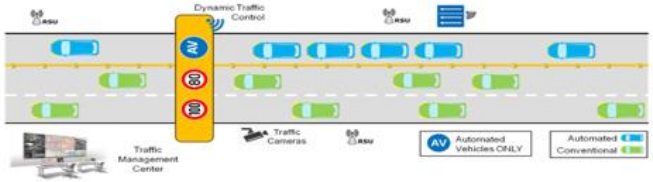
Website: https://www.inframix.eu/

Social media: @inframix INFRAMIX project

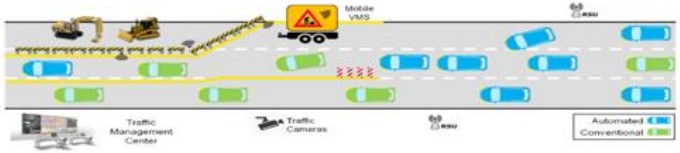
Traffic scenarios & use cases

Three traffic scenarios under investigation :

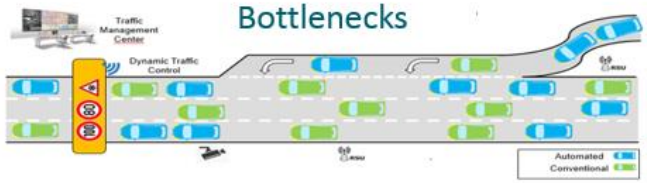
Dynamic lane assignment to automated driving



Roadworks zone



Bottlenecks



Selection criteria:

a) expected **impact on traffic flow**

b) expected **impact on traffic safety**

c) importance of **the challenges faced**, in the sense that if not handled in a proper and timely way, they will negatively **influence the introduction of automated vehicles on the roads**

d) ability to **generalize on the results** (applicable in other scenarios and environments)

Traffic scenarios & use cases

Scenario 1: Dynamic Lane Assignment (incl. speed recommendations)

1. Real time lane assignment under Dynamic Penetration Rate of Automated Vehicles (AVs)
2. Exceptional circumstances e.g. adverse weather conditions
3. A conventional vehicle drives on a dedicated lane for AVs

Scenario 2: Roadworks zones

4. Roadworks zone in mixed traffic – Single Lane Closure
5. Roadworks zone in mixed traffic – New lane Design

Scenario 3: Bottlenecks

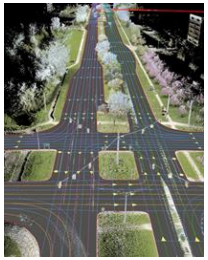
6. AVs Driving Behaviour Adaptation in Real Time at Sags
7. Lane-Change Advice to connected vehicles at Bottlenecks
8. Lane-Change Advice combined with Flow Control at Bottlenecks for all vehicles

“Hybrid” road infrastructure

“Hybrid” road vision: a road infrastructure consisted of physical and digital infrastructure elements able to cope efficiently with the new safety challenges emerging from the introduction of automated vehicles.

Especially important to support the transition period and mixed traffic scenarios:

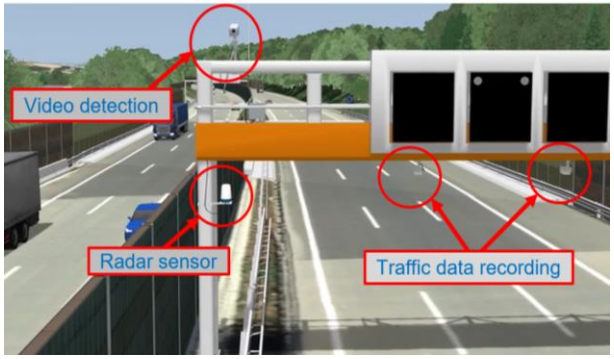
- Extend the electronic horizon of automated vehicles
- Facilitate the co-operation between different types of vehicles with different capabilities (manually driven, connected, automated – different levels of automation)
- Manage and control traffic in a safe and efficient way
- Provide consistent electronic and visual signals for all types of vehicles

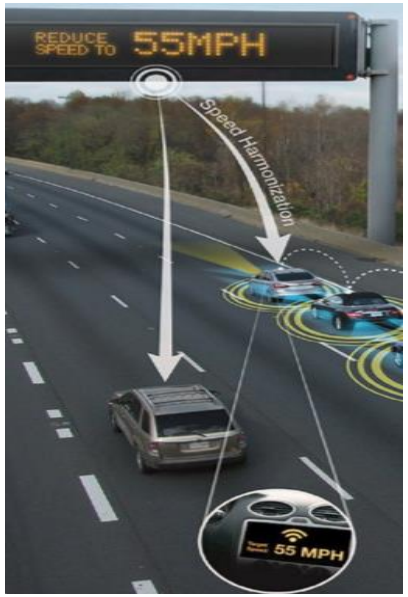


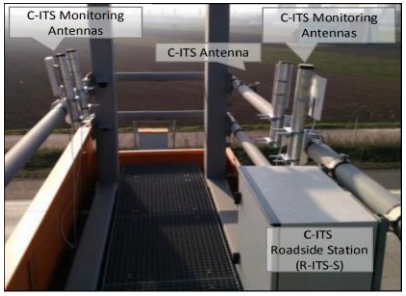
“Hybrid” road infrastructure

Physical road infrastructure

- Visual and electronic signaling to inform and guide both conventional and automated vehicles
- Road side elements and related upgrades of today Traffic Management Centers (TMCs).







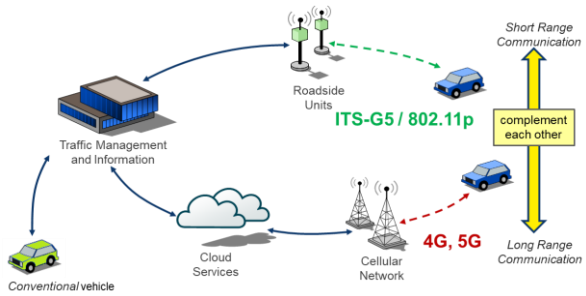
“Hybrid” road infrastructure

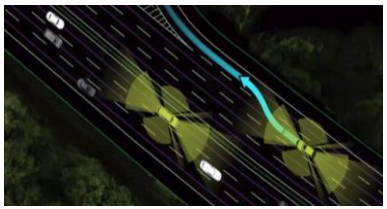
Today

Tomorrow

Digital road infrastructure

- Highly accurate digital maps
- Traffic flow estimation methods for mixed traffic
- Investigation of different novel traffic management architectures and combinations
- Individualized speed and lane recommendations
- Definition of dedicated ITS specific messages
- Usage of short range (e.g. ITS-G5, WiFi)
  and long range (cellular) communication

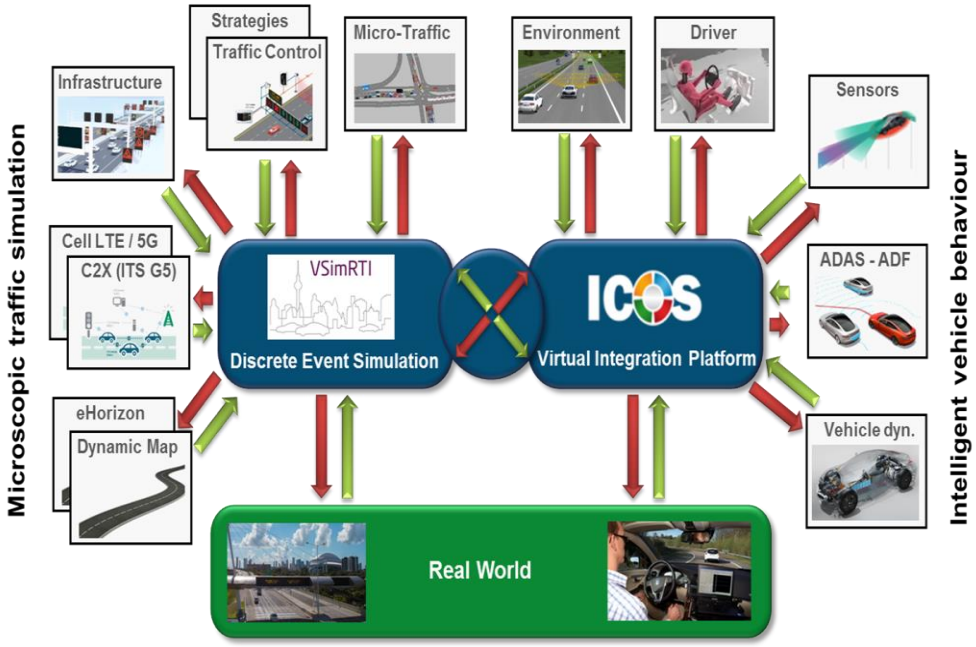




Simulation environment

Microscopic traffic simulation

- realistic mobility pattern for a multitude of vehicles
- Cellular (LTE or 5G) & WLAN based ad hoc communication (ETSI ITS) (OMNeT or ns-3)
- Modelling the functionality of Informing vehicles with VMS
- Infrastructure sensor models
- Overall traffic flow



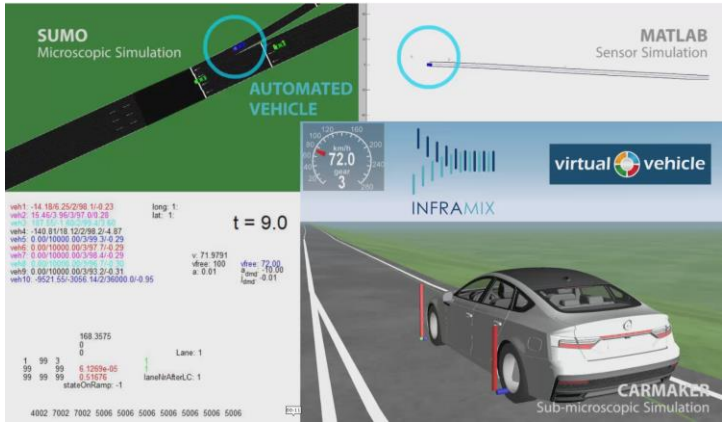
Submicroscopic simulation

- Vehicle sensors models
- Detailed trajectory for the single vehicle : conventional vehicle (incl. human driving behaviour) & automated vehicle
- Simulation of the vehicle physical properties: engine acceleration , brakes, suspension

Simulation environment

The INFRAMIX Co-simulation environment combines the modelling of the vehicle behaviour with the traffic simulation enabling the :

- Investigation of several cases with safety critical impact (e.g. for the roadworks zones scenario).
- Testing of the developed traffic control algorithms (e.g. for the bottlenecks scenario)
  - with **increased traffic densities** in exceptional conditions
  - with **different rates** of the targeted vehicle types (conventional, automated).
- Scenarios testing under adverse weather conditions.

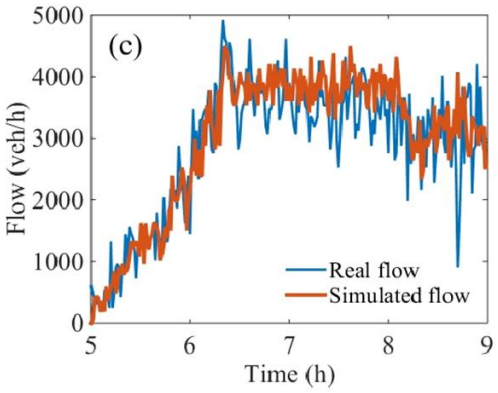


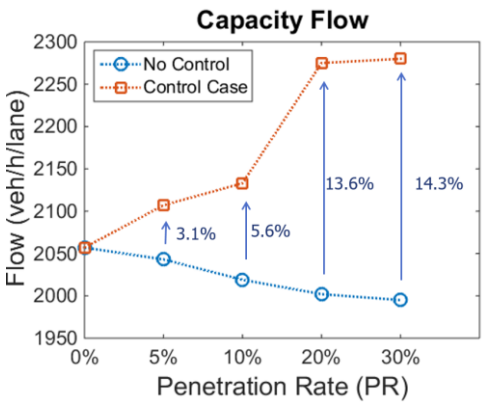
Traffic estimation & control

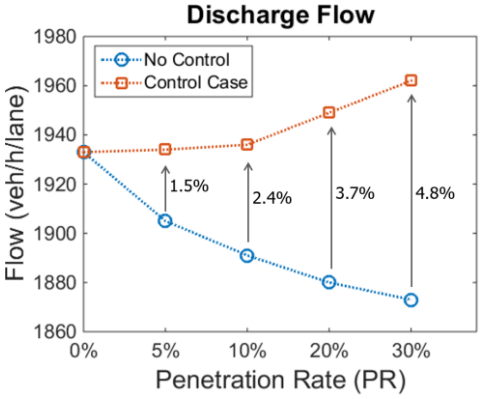
INFRAMIX will address the major **novel traffic management** opportunities arising from the emergence of a **variety of automation** and **connectivity capabilities** with **various penetration rates**.

Design and implement novel **traffic estimation, monitoring and control strategies** dynamically adapted to

- the **different penetration levels of automated vehicles**,
- the **infrastructure equipment**
- and the **overall traffic status**.



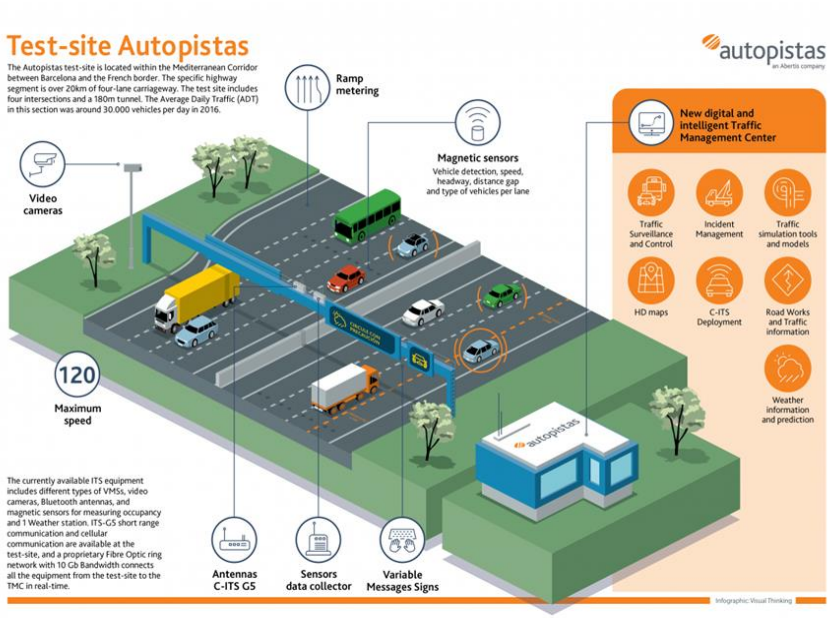




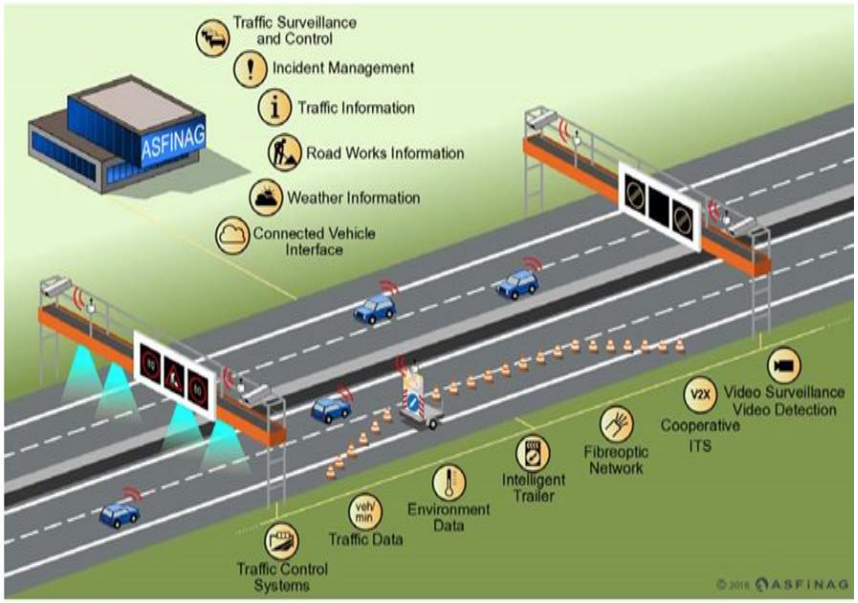
Real tests

2 modern highways for real tests

Girona (Spain)



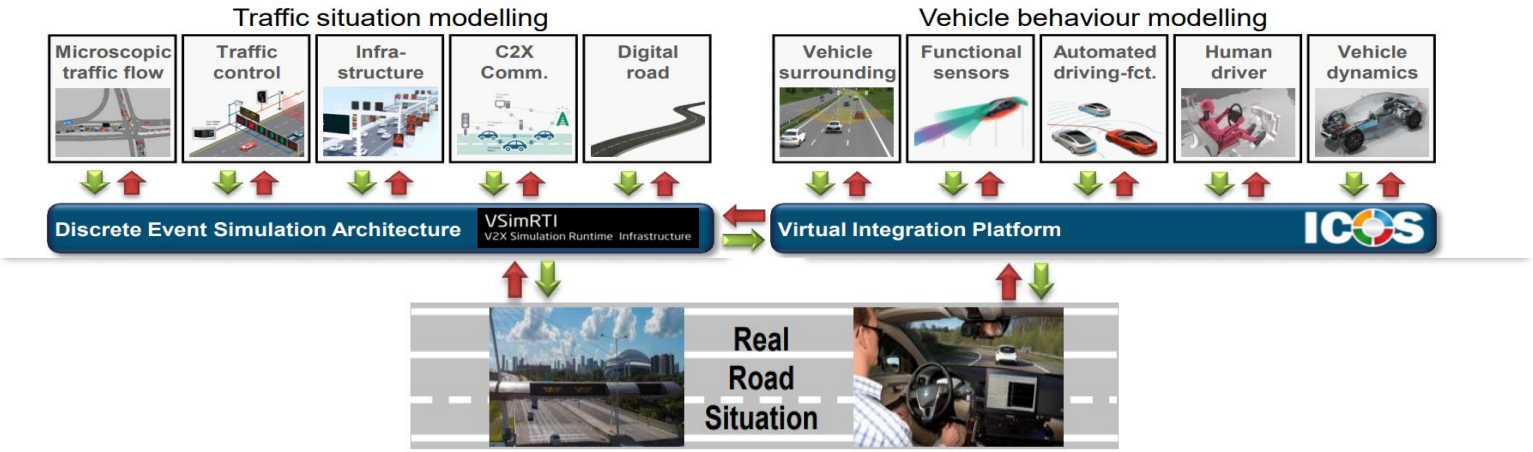
Graz (Austria)



Traffic Scenarios	Spain	Austria	Hybrid testing	Co-simulation environment
Dynamic Lane Assignment	X			X
Roadworks		X	X	X
Bottlenecks	X	X	X	X

Hybrid testing

Hybrid testing: coupling infrastructure elements and vehicles on real roads with virtual traffic environment



A real vehicle and real digital infrastructure elements will be embedded into a virtual environment to test, validate and demonstrate the impact of infrastructure measures in specific scenarios in terms of road safety and traffic efficiency.

This hybrid testing enables detailed and realistic investigations of real driving behaviour in a complex but safe virtual traffic to demonstrate the potential of INFRAMIX.

Road infrastructure classification scheme

Overview:

- The classification scheme is based on a set of attributes / indicators which signify whether the specific infrastructure matches the requirements of different levels of automated vehicles (e.g. L3 or L4/L5)

Objective:

- To highlight the connectivity and automation capabilities of the infrastructure and its ability to manage the circulation of vehicles of different levels of automation

Targets:

- Indicate the infrastructure connectivity, automation capabilities, capability to host vehicles of different levels of automation and connectivity.
- Provide dynamic classification–under certain conditions (e.g. an incident, extreme weather conditions) the circulation of automated vehicles will be affected
- Consist a guide of how to incrementally upgrade levels of infrastructure to avoid stranded investments.

Highlights

1) INFRAMIX (H2020 project) prepares road infrastructure for **mixed traffic** and aims to influence community and stakeholders through **Infrastructure classification scheme;**
2) Provides a **simulation platform** and **hybrid system testing** of high value for future research**;**
3) Implements **novel traffic monitoring and control;**
4) Evaluates **users appreciation** and **traffic safety** in mixed traffic through **dynamic lane assignment**, **roadworks zones** and **bottlenecks** traffic scenarios;
5) Propose **new traffic signaling** for the needs of mixed traffic;
6) Propose **extensions to V2X** communication **standardization** bodies.

Keep track on INFRAMIX

- Website: https://www.inframix.eu/
- Twitter: @inframix
- Linkendin: INFRAMIX project

- Sign up to our newsletter:

  https://lists.inframix.eu/wws/subscribe/news

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