

Preparing road infrastructure for mixed vehicle traffic flows

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Outline



- ▶ INFRAMIX project – Overview & Objectives
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- ▶ “Hybrid” road infrastructure
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- ▶ Road infrastructure classification scheme
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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 project general facts:

Duration: 1 June 2017-31 May 2020

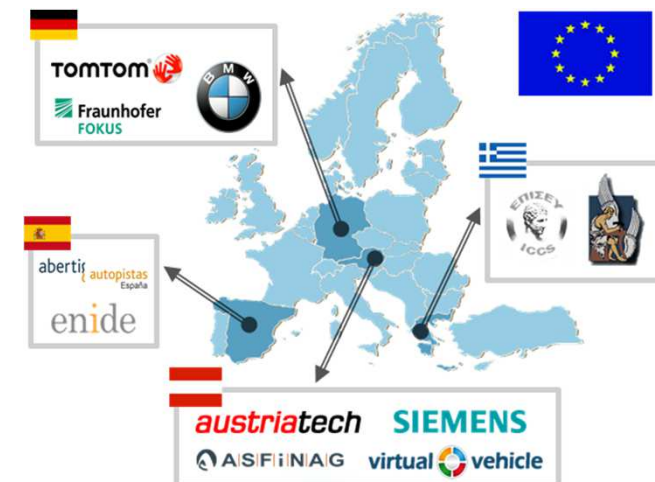
EC Funding: 5M €

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

Social media:  @inframix  INFRAMIX project

Coordinator: AustriaTech

Consortium: AustriaTech, ICCS, Asfinag, Autopistas, BMW, Enide, Fraunhofer, Siemens, Technical University of Crete, TomTom, Virtual Vehicle



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**; combining the modelling of the vehicle behaviour with the traffic simulation
- ▶ Develop **hybrid testing system**; coupling infrastructure elements and vehicles on real roads with virtual traffic environment
- ▶ **Evaluate user's appreciation** and **acceptance**
- ▶ Evaluate **traffic safety**
- ▶ Create a **Road Infrastructure Classification Scheme**



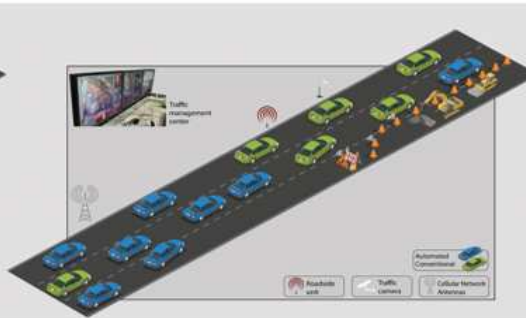
Traffic scenarios

Three traffic scenarios under investigation :

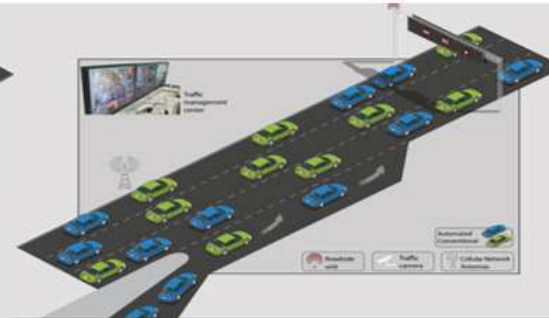
Dynamic lane assignment to automated driving



Roadworks zone



Bottlenecks



Selection criteria:

- expected **impact on traffic flow**
- expected **impact on traffic safety**
- 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**
- ability to **generalize on the results** (applicable in other scenarios and environments)

“Hybrid” road infrastructure

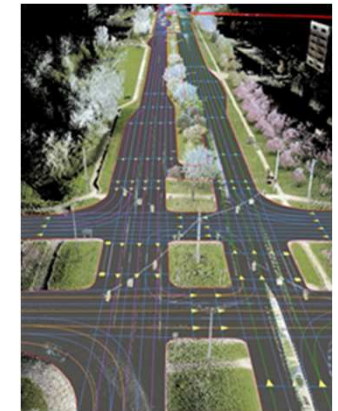


“Hybrid” road infrastructure vision

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.

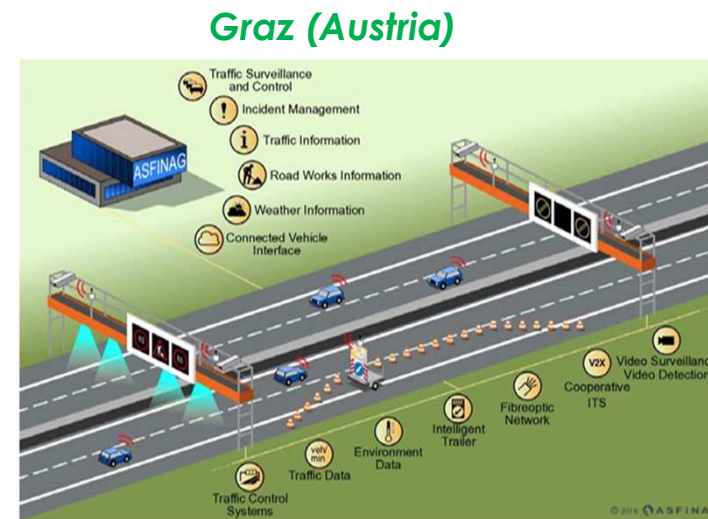
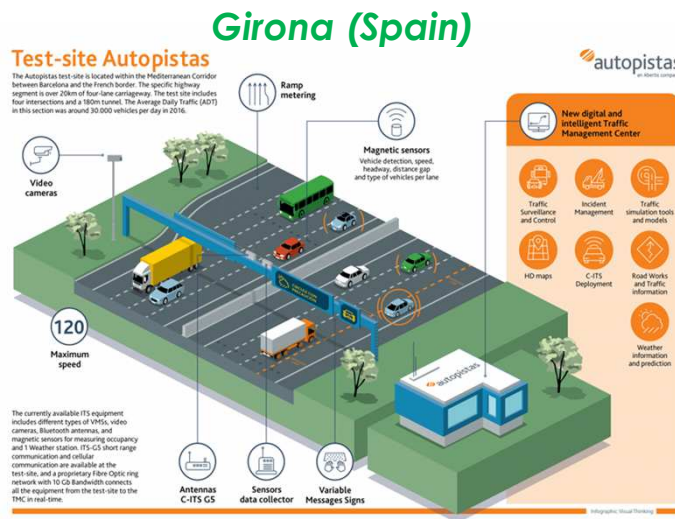
Especially important to support the *transition period* and *mixed traffic* scenarios:

- ▶ 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



Real tests

2 modern highways for real demonstration



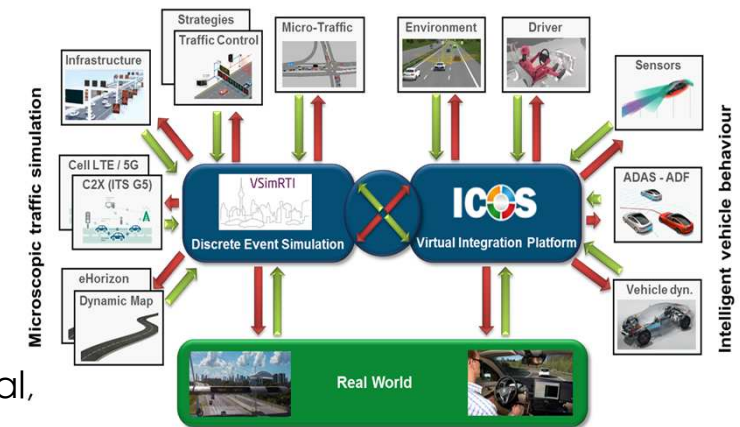
Traffic Scenarios	Spain	Austria	Hybrid testing	Co-simulation environment
Dynamic Lane Assignment	X			X
Roadworks		X	X	X
Bottlenecks	X	X	X	X

Simulation environment

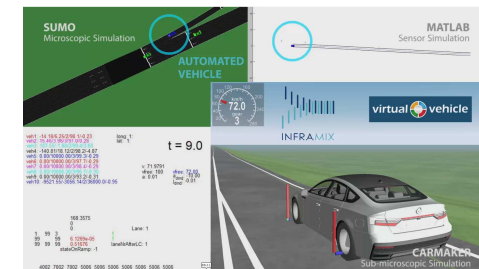


The INFRAMIX **Co-simulation environment** combines modelling of the vehicle behaviour with traffic simulation enabling the:

- 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



The **Hybrid testing** couples infrastructure elements and vehicles on real roads with virtual traffic environment enabling detailed and realistic investigations of **real driving behaviour** in a complex but safe **virtual traffic**



Road infrastructure classification scheme



Overview: The classification scheme will be 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



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



Thank you for your attention!

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