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# INFRAMIX – Project overview

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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 723016.

# Project facts

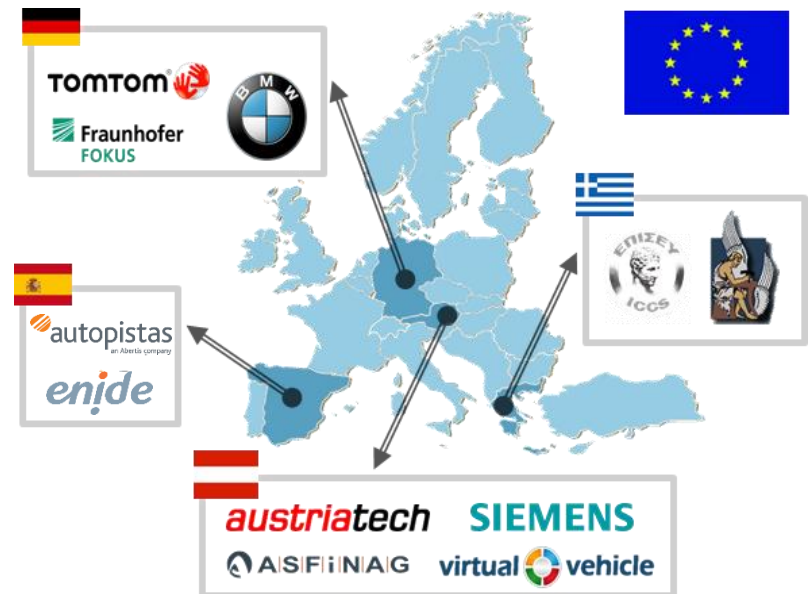
**Duration:** 1 June 2017-31 May 2020

**EC Funding:** 5M €

**Coordinator:** *AustriaTech*

**Consortium:**

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



# INFRAMIX overview

## Focus

- Mixed traffic: Automated & connected, connected, conventional vehicles (different levels of penetration)
- Road infrastructure (high level road network)

## 3 Key Scenarios

- Dynamic lane assignment
- Roadworks zone
- Bottlenecks

## Solutions

- comprising new traffic management and control strategies, new physical and digital road infrastructure elements (define, specify, develop, implement)

## Evaluation Tools

- Development of co-simulation framework
- Real world implementation
- Combination of real world and simulation (=Hybrid testing)

## Recommendations

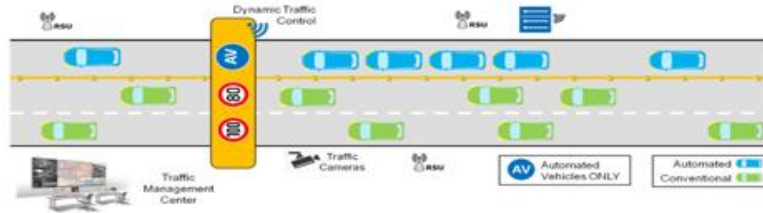
- Infrastructure classification scheme
- Safety performance criteria
- Roadmap towards a fully automated transport system
- Exploitation plans

# INFRAMIX Project Objectives

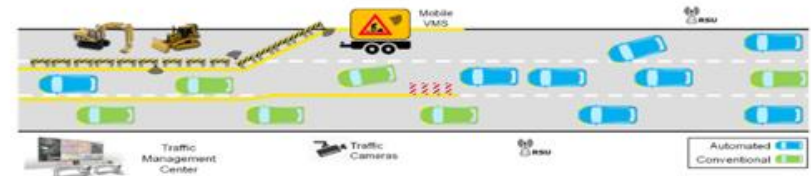
- Design new and upgrade existing **physical & digital road infrastructure elements**
- Design **novel signalling** and **visualisation elements**
- Design and implement **novel traffic estimation, monitoring and control strategies**
- Develop a **co-simulation environment**
- Develop a **hybrid testing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

# Use Case definitions - Basis for INFRAMIX activities

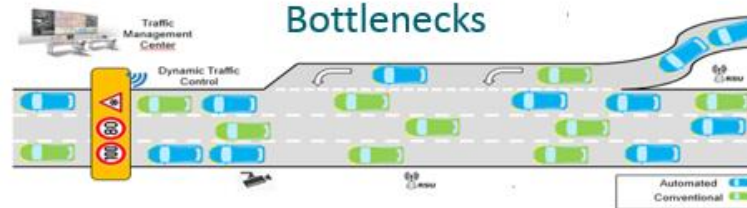
## Dynamic lane assignment to automated driving



## Roadworks zone

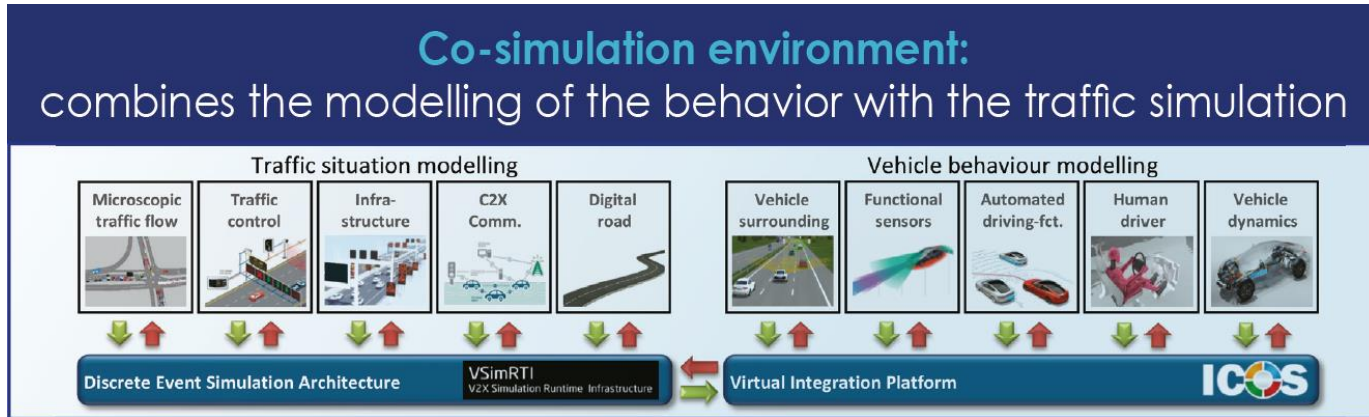


## Bottlenecks



- Status quo of test sites and simulation tools as a starting point
- Definition of requirements:
  - functional
  - feasibility
  - non-functional
- Linking of requirements to major INFRAMIX components
- Comprehensive information on the use cases is available on the INFRAMIX website (D2.1)

# Co-simulation environment



- Advanced traffic flow modelling has been realized with the INFRAMIX Co-simulation environment
- Will be used for the evaluation of the three INFRAMIX scenarios for highways.
- The Co-simulation environment consists of
  - VSimRTI for microscopic traffic simulation
  - ICOS for sub microscopic traffic simulation
- Description of the co-simulation environment is available on the INFRAMIX website (D2.2)

# Road Infrastructure Classification Scheme

## **Objective:**

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

## **Targets:**

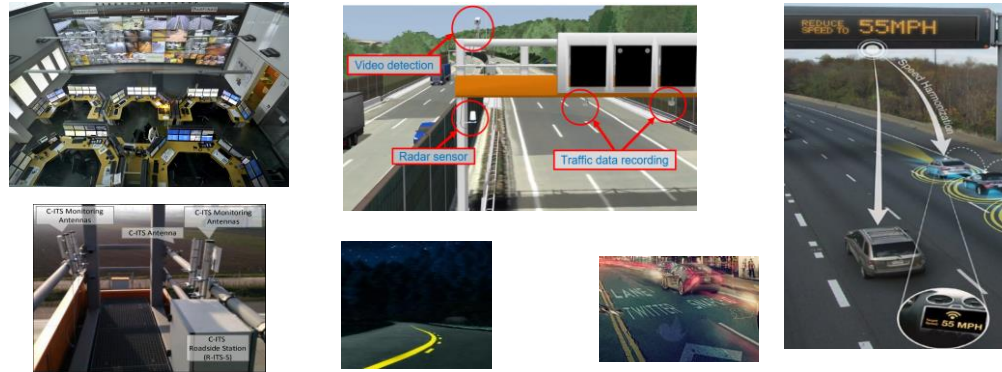
- Indicate the infrastructure connectivity, automation capabilities, capability to host vehicles of different levels of automation and connectivity
- Provide dynamic classification – under certain conditions (e.g. an incident, extreme weather conditions) the circulation of automated vehicles will be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

# Design and implement novel traffic estimation, monitoring and control strategies

- **Traffic estimation, monitoring and control strategies dynamically adapted to**
  - different penetration levels of automated vehicles,
  - infrastructure equipment
  - overall traffic status
- **Investigation of:**
  - exploiting AV capabilities towards increased traffic flow efficiency and safety
  - increasing the bottleneck capacity by achieving a prespecified (possibly traffic-dependent) lane distribution of vehicles while approaching a bottleneck
  - improving the traffic flow at bottlenecks by controlling the upstream flow (investigation of several innovative flow control strategies)



# Physical & digital road infrastructure elements and novel signaling and visualization elements

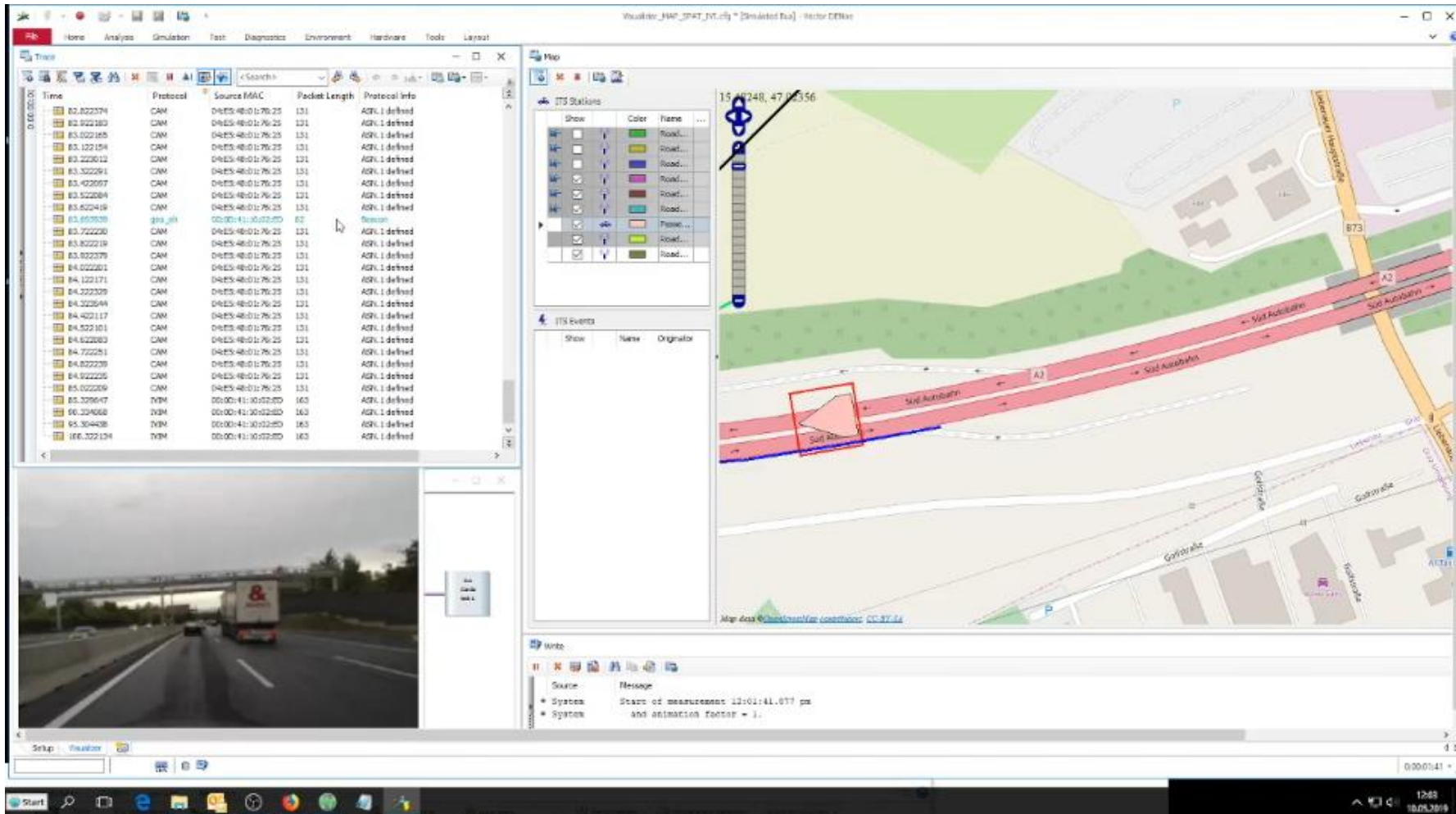


- Design new and upgrade existing physical & digital road infrastructure elements
- Design novel signaling and visualization elements
- “Hybrid” infrastructure (physical and digital) able to cope efficiently with the new safety challenges
- Static and dynamic digital representation of the physical world with which the automated vehicle will interact to operate
  - New traffic signs for mixed traffic
  - Novel traffic monitoring recommendations (wireless messages extensions)

# Testweek report 9-10 May



# Testweek report 9-10 May

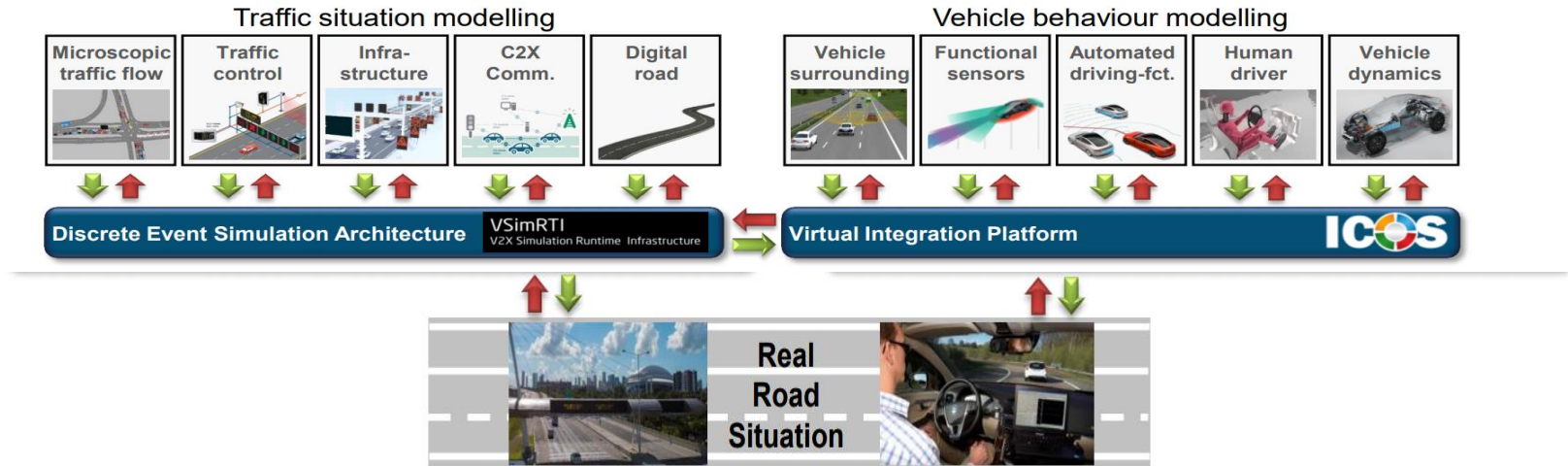


The screenshot displays the INFRAMIX software interface, which is used for simulating traffic and infrastructure. The interface is divided into several panels:

- Top Panel:** Contains a menu bar with options like File, Home, Analysis, Simulation, Test, Diagnostics, Environment, Hardware, Tools, and Layout. Below the menu is a toolbar with various icons for simulation control.
- Left Panel (Data Table):** A table with columns: Time, Protocol, Source MAC, Packet Length, and Protocol Info. It lists simulation data points, including timestamps, protocols (CAM, NVM), source MAC addresses, packet lengths, and protocol information (e.g., ASRL defined).
- Map Panel:** A large map view showing a road network. A red line indicates a specific road or path. A blue line with a car icon represents a vehicle's trajectory. The map includes labels for roads like 'A2' and 'Sud Autobahn'. A coordinate system is visible in the top left of the map area.
- Bottom Left Panel:** A video feed showing a real-world view of a road with a truck and other vehicles.
- Bottom Right Panel:** A 'Write' panel with a 'Message' field. It contains text: 'Start of measurement 12:01:41.077 pm and animation factor = 1.1'.

The status bar at the bottom of the window shows the time '12:48' and the date '18.05.2019'.

# Hybrid testing system



Coupling infrastructure elements and vehicles on real roads with virtual traffic environment

- Enables detailed and realistic investigations of real driving behaviour in a complex but safe virtual traffic to demonstrate the potential of INFRAMIX.
- Testing of new developments of connected and automated driving
- Emulation of critical traffic situation in a safe artificial environment

# Traffic safety and user's appreciation & acceptance

- Evaluation of
  - users appreciation and
  - traffic safety
  - in mixed traffic through dynamic lane assignment, roadworks zones and bottlenecks traffic scenarios
- 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 conventional and automated vehicles.



# Potential impact of the project

- New traffic estimation and control algorithms for mixed traffic environments
- Simulation environments and hybrid testing for mixed traffic situations
- Extension of traffic messages
- Extensions of existing technologies
- Infrastructure classification scheme (for automation levels of vehicles)
- Set of minimum interventions for infrastructure upgrades
- New safety parameters for assessment



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