INFRAMIX – Project overview

David Quesada / ENIDE

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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

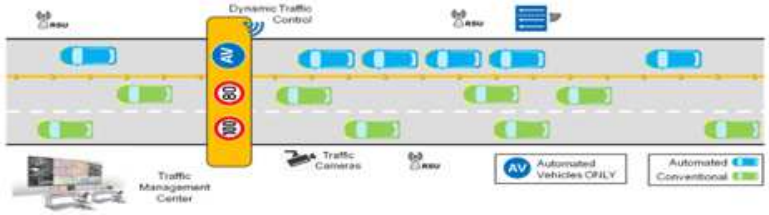
Focus	• Mixed traffic: Automated & connected, connected, conventional vehicles (different levels of penetration) • Road infrastructure (high level road network)
3 Key Scenarios	• Dynamic lane assignment • Roadworks zone • Bottlenecks
Solutions	• comprising new traffic management and control strategies, 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

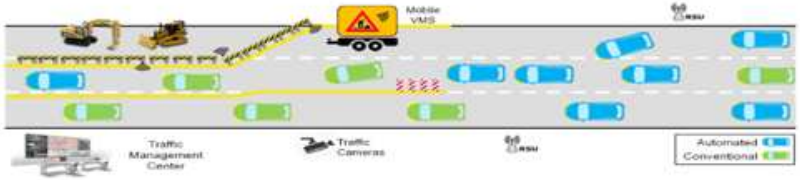
- Design new and upgrade existing **physical** & **digital road infrastructure elements**
- Design **novel signalling** and **visualisation elements**
- Design and implement **novel traffic estimation**, **monitoring** and **control strategies**
- Develop a **co-simulation environment**
- Develop a **hybrid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

Use Case definitions - Basis for INFRAMIX activities

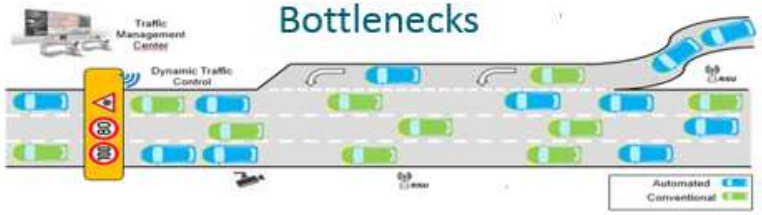
Dynamic lane assignment to automated driving



Roadworks zone

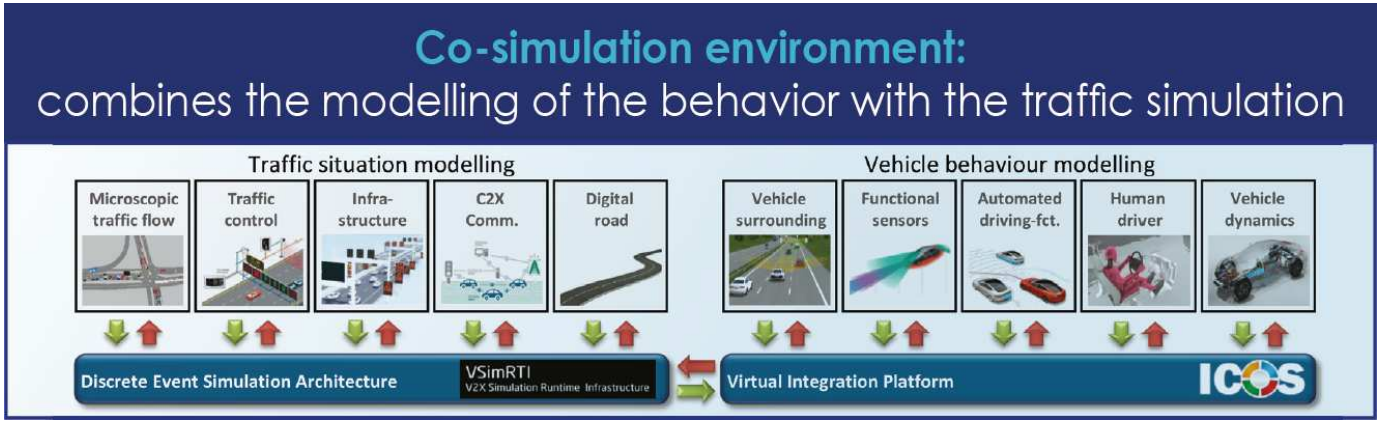


Bottlenecks



- 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

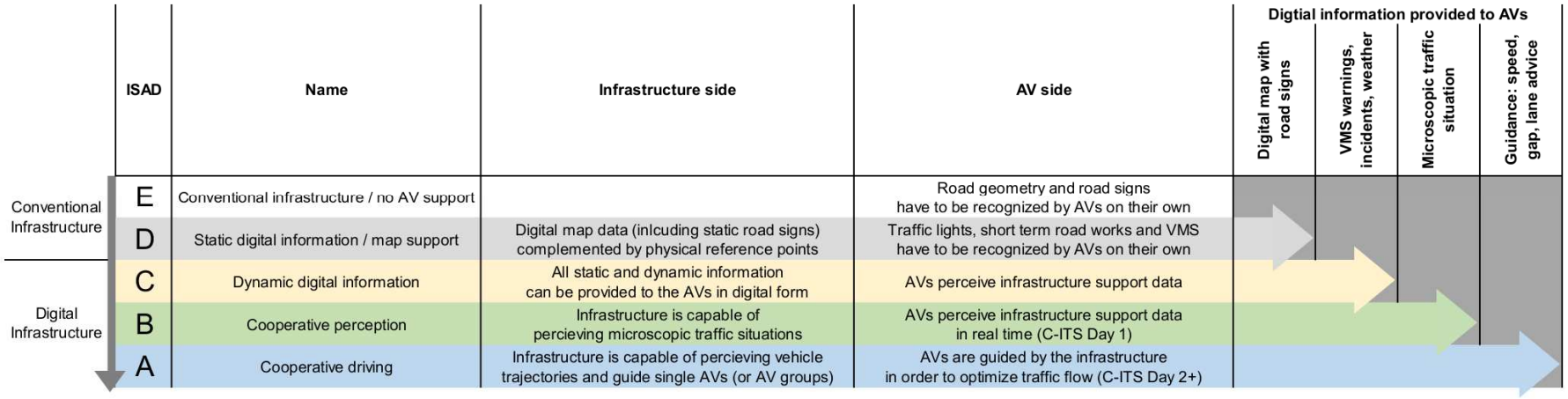
Objective:

- 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

Road Infrastructure Classification Scheme



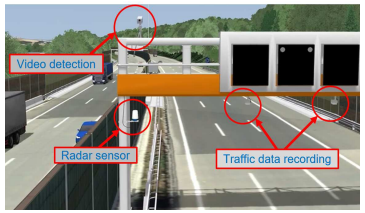
	ISAD	Name	Infrastructure side	AV side	Digtial information provided to AVs: Digital map with road signs	VMS warnings, incidents, weather	Microscopic traffic situation	Guidance: speed, gap, lane advice
Conventional Infrastructure	E	Conventional infrastructure / no AV support		Road geometry and road signs have to be recognized by AVs on their own				
	D	Static digital information / map support	Digital map data (inlcuding static road signs) complemented by physical reference points	Traffic lights, short term road works and VMS have to be recognized by AVs on their own				
Digital Infrastructure	C	Dynamic digital information	All static and dynamic information can be provided to the AVs in digital form	AVs perceive infrastructure support data				
	B	Cooperative perception	Infrastructure is capable of percieving microscopic traffic situations	AVs perceive infrastructure support data in real time (C-ITS Day 1)				
	A	Cooperative driving	Infrastructure is capable of percieving vehicle trajectories and guide single AVs (or AV groups)	AVs are guided by the infrastructure in order to optimize traffic flow (C-ITS Day 2+)				

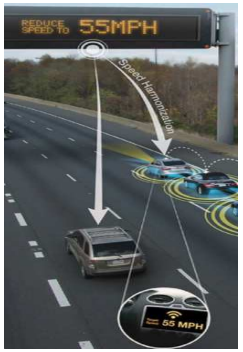
Design and implement novel traffic estimation, monitoring and control strategies

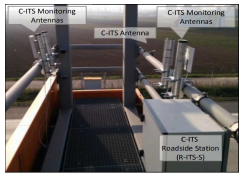
- **Traffic estimation, monitoring and control strategies dynamically adapted to**
  - different penetration levels of automated vehicles,
  - infrastructure equipment
  - overall traffic status

- **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



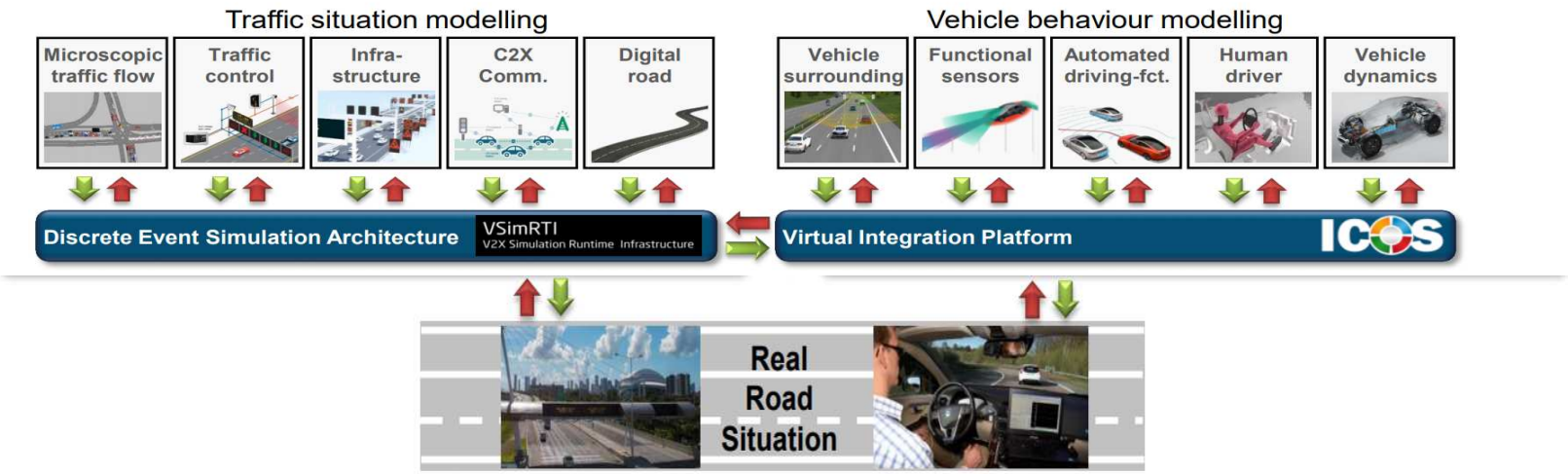




- Design new and upgrade existing physical & digital road infrastructure elements
- Design novel signaling and visualization elements
- "Hybrid" infrastructure (physical and digital) able to cope efficiently with the new safety challenges
- Static and dynamic digital representation of the physical world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

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

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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