
INFRAMIX

Overview of main results (so far)

David Quesada, Enide



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

INFRAMIX – Preparing road infrastructure for mixed vehicle traffic flows

Duration: 1 June 2017-31 May 2020

EC Funding: 5M €

Coordinator: AustriaTech

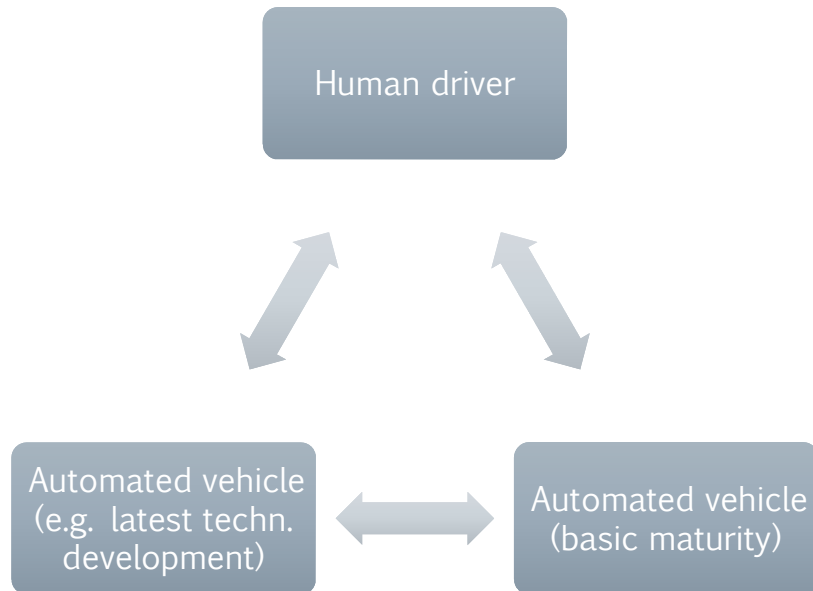
Consortium:

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



Mixed traffic situations will increase

- › Human drivers and automated vehicles need to interact
- › Automated vehicles will differ in functions and technical maturity
- › Capabilities of specific automated vehicles are not known to other road users (incl. other automated vehicles)
- › Uncertainty about the behaviour of other traffic participants will decrease the quality of interaction
- › Efficiency and safety
 - depend on smooth interaction
 - will likely decrease in case of mixed traffic situations, if no measures are set

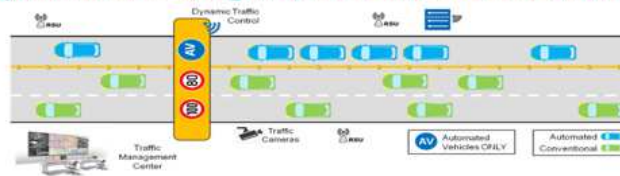


Infrastructure support can increase efficiency and safety in mixed traffic situations

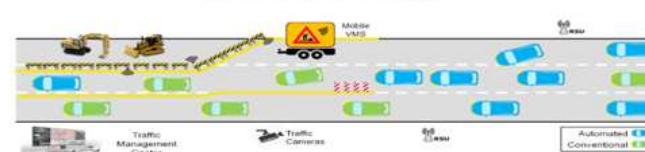
> INFRAMIX scenarios :

- setting up a dedicated lane for automated vehicles in certain traffic conditions
- giving automated vehicles additional support for roadworks zones
- using appropriate control strategies for bottlenecks

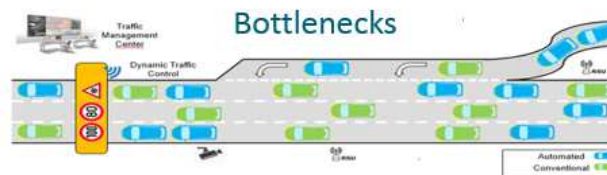
Dynamic lane assignment to automated driving



Roadworks zone



Bottlenecks

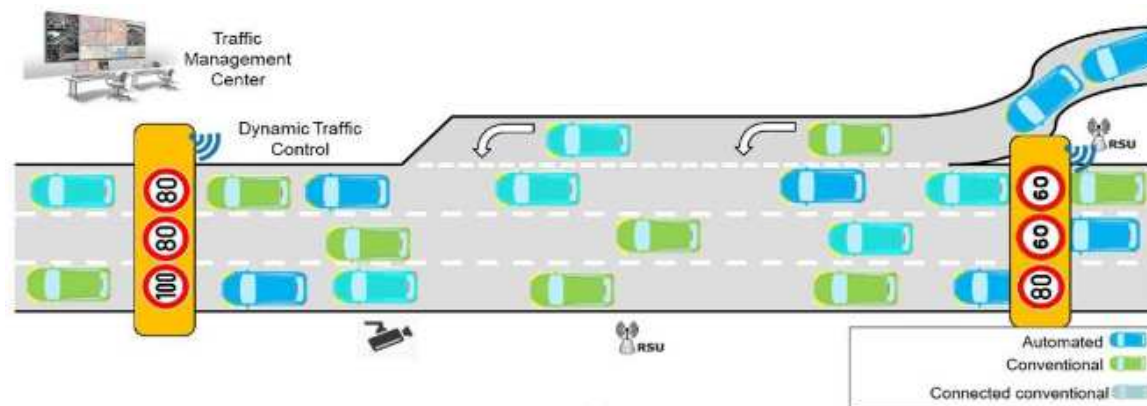


INFRAMIX solutions address different levels

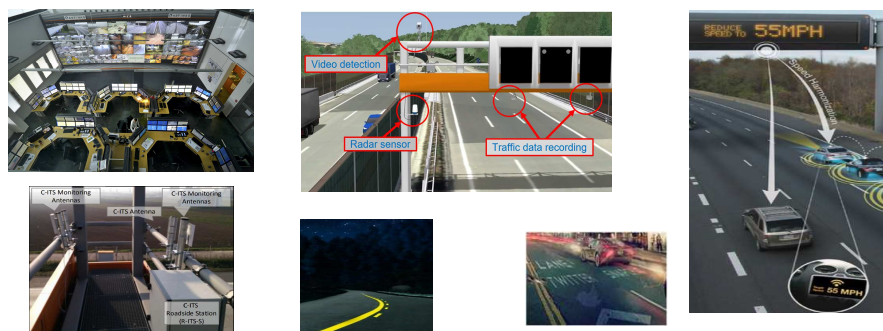
- › Support of automated vehicles with information
 - e.g. on weather conditions, road work zones or incidents ahead
 - Vehicles can adapt in advance to conditions ahead
- › Direct support for automated vehicles, e.g.
 - Precise maps of road work zones layout
 - Transmitting mandatory traffic signs via electronic messages
- › Control strategies for mixed traffic situations
 - at bottlenecks
 - activate and deactivate a dedicated lane for automated vehicles

INFRAMIX solutions: Traffic estimation and control strategies

- › New traffic estimation algorithms have been developed
- › New traffic control algorithms have been developed
 - Gap and acceleration advice
 - Mainstream traffic flow control
 - Lane change advice
- › Tests have been carried out
- › Evaluation phase is running currently → Detailed evaluation results will be available in the end of the project



Inframix solutions: digital and physical infrastructure



- A system architecture to be able to address both conventional and automated vehicles has been designed and developed
- Vehicles are addressed by ITS-G5 and cellular communication
- INFRAMIX system was implemented in the test-sites in Spain and Austria
- Tests (including end-user tests) have been carried out at both test sites successfully
- Detailed description of physical and digital elements is available (including functionalities, interfaces and messages)
- Visual signs required to realise the INFRAMIX use cases have been analysed and developed and implemented (digitally as well as directly on the road)



INFRAMIX solutions: Road Infrastructure Classification Scheme

- Infrastructure classification scheme for automated driving (ISAD) has been developed
- Classification of the level of support for automated vehicles provided by the infrastructure
- Could allow to keep up ODDs for longer time and reduce number of handovers
- Support timely deployment of automation-appropriate infrastructure networks
- Has been presented and discussed (amongst others in workshops) with a lot of stakeholders
- A detailed description is available on the INFRAMIX website

Infrastructure Support levels for Automated Driving (ISAD)

	Level	Name	Description	Digital information provided to AVs			
				Digital map with static road signs	VMS, warnings, incidents, weather	Microscopic traffic situation	Guidance: speed, gap, lane advice
Conventional infrastructure	E	Conventional infrastructure / no AV support	Conventional infrastructure without digital information. AVs need to recognise road geometry and road signs.				
	D	Static digital information / Map support	Digital map data is available with static road signs. Map data could be complemented by physical reference points (landmarks signs). Traffic lights, short term road works and VMS need to be recognized by AVs.	X			
Digital infrastructure	C	Dynamic digital information	All dynamic and static infrastructure information is available in digital form and can be provided to AVs.	X	X		
	B	Cooperative perception	Infrastructure is capable of perceiving microscopic traffic situations and providing this data to AVs in real-time.	X	X	X	
	A	Cooperative driving	Based on the real-time information on vehicle movements, the infrastructure is able to guide AVs (groups of vehicles or single vehicles) in order to optimize the overall traffic flow.	X	X	X	X

Road infrastructure support levels for automated driving, Anna Carreras, Xavier Daura, Jacqueline Erhart, Stefan Ruehrup, 25th ITS World Congress, Copenhagen, Denmark, 17-21 September 2018



INFRAMIX Summary

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 final event



The graphic is divided into two main sections. The left section shows a close-up of a calendar page with a fountain pen nib resting on it. A yellow brushstroke highlights the text "SAVE THE DATE" in a bold, black, sans-serif font. The right section is a white background with a teal border. It features the INFRAMIX logo at the top, followed by the text "FINAL EVENT" in a spaced-out, blue, sans-serif font. Below this, the date "4 May, 2020" is displayed with a teal circle containing the number "4", and the location "Graz, Austria" is shown with a teal location pin icon. At the bottom left of the right section is the European Union flag, and at the bottom right is a small text block: "This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 723016."

<https://www.eventbrite.es/e/inframix-final-event-tickets-94169628895>



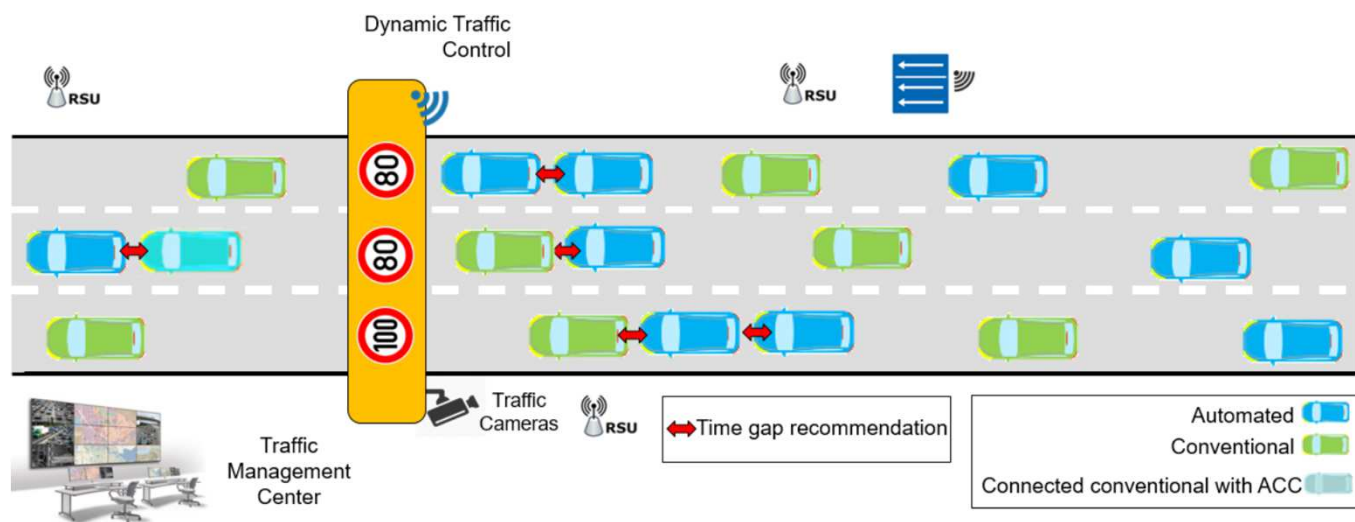
enide

David Quesada
david.quesada@enide.com



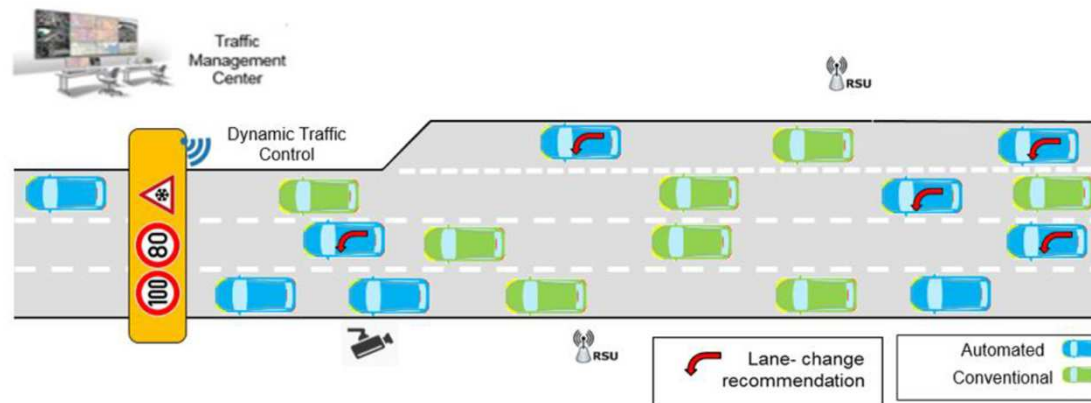
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Automated vehicles (AV) Driving Behaviour Adaptation in Real Time at Sags

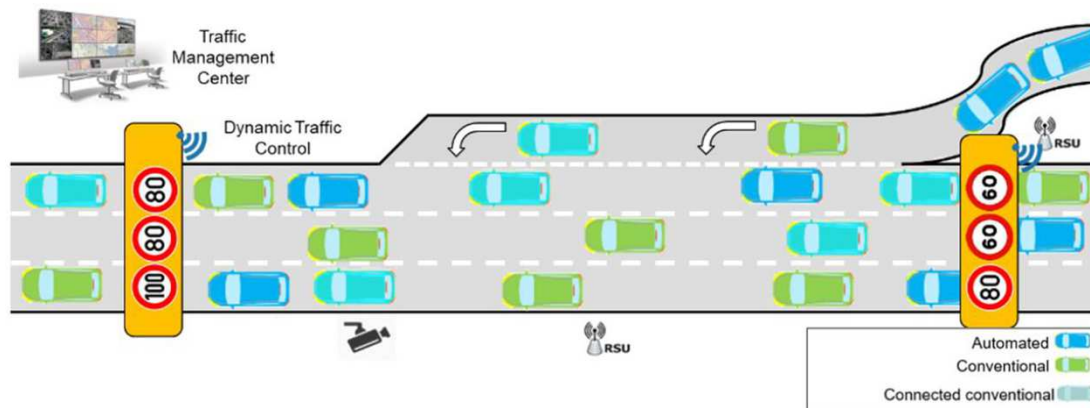


Automated vehicles (AV) Driving Behaviour Adaptation in Real Time at Sags – INFRAMIX D2.1

Lane-Change Advice combined with Flow Control at Bottlenecks for all vehicles



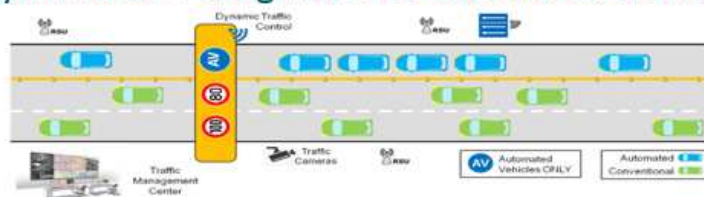
Lane-change advice to connected vehicles at bottlenecks- INFRAMIX D2.1



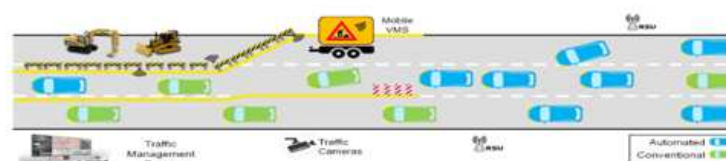
Mainstream Traffic Flow Control (MTFC) – INFRAMIX D2.1

INFRAMIX Scenarios and Use Cases – Basis for INFRAMIX activities

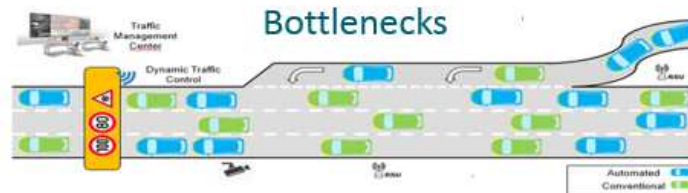
Dynamic lane assignment to automated driving



Roadworks zone



Bottlenecks



Dynamic Lane Assignment (incl. speed recommendations)

- Real time lane assignment under dynamic penetration rate of automated vehicles
- Exceptional circumstances e.g. adverse weather conditions
- A conventional vehicle drives on a dedicated lane for automated vehicles

Bottlenecks

- Automated vehicles driving behaviour adaptation in real time at sags
- Lane change advice to connected vehicles at bottlenecks
- Lane change advice combined with flow control at bottlenecks for all vehicles

Roadworks zones

- Single lane closure (e.g. short term constructions)
- New lane design (e.g. long term constructions)