12th ITS EUROPEAN CONGRESS
ITS BEYOND BORDERS
Strasbourg, France | 19-22 June 2017

Managing Highly Automated Vehicles

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Starting point 1

Safe and connected automation in road transport – H2020 call MG3.6a - 2015

Specific challenge: Automated and progressively autonomous driving applications in road transport, **actively interacting with their intelligent environment** could provide an answer to the EU objective of reconciling growing mobility needs with more efficient transport operations, lower environmental impacts and increased road safety.

…

Automation in road transport should **make best use of the evolution of Cooperative ITS** and the benefits made available by satellite navigation systems, such as the increased accuracy and robustness.

…

Novel **transport, service and mobility concepts** in real-life situations enabled by automated driving and connectivity. These services and concepts could benefit from cloud computing and data management and data aggregation techniques for road transport big data.

Starting point 2

Road infrastructure to support the transition to automation and the coexistence of conventional and automated vehicles on the same network – H2020 call ART-05 - 2016

Specific challenge: The foreseen step-wise introduction of automated vehicles in traffic will face a transition period where the **coexistence of conventional and highly automated vehicles will have to be managed** in order to ensure an **uninterrupted level of safety and efficiency**. Road infrastructure will play a major role in managing this transition period.

…

Design, upgrading and adaptation of **"hybrid" infrastructure** (able to take into account the coexistence of fully or partially automated (connected or autonomous) and conventional vehicles).

…

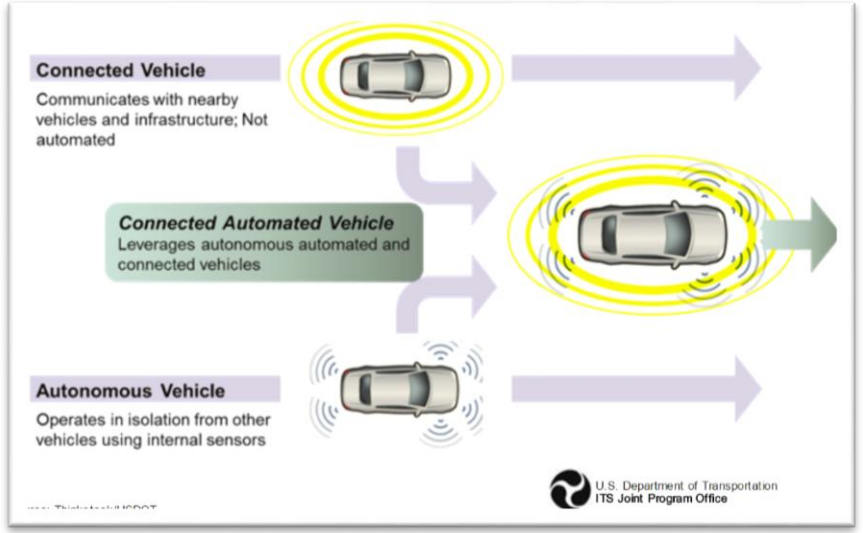
Required forms of visual and electronic **signalling and optical guidance**, ensuring readability by both automated and conventional vehicles, and enabling automated driving in also adverse road weather conditions.

…

Best ways to enlarge the electronic road horizon for automated vehicle ensuring timely reaction to hazards ahead via **real-time warnings and information, traffic management plans**, up-to-date digital maps, etc.

An intelligent environment

Includes infrastructure!



- Communication is a precondition for highly automated driving
- Traffic management and control remain necessary
  - Safeguard societal interests
  - Setting constraints and rules
  - Intervene in case of oversaturated conditions

- High automated vehicles interact with intelligent infrastructure
- Offers new possibilities for traffic management and control optimisations
- Different perspectives:
  - Each vehicle individually (autonomous)
  - Vehicles part of a group process (e.g. platoon)
  - Vehicles part of a system process (e.g. intersection control)

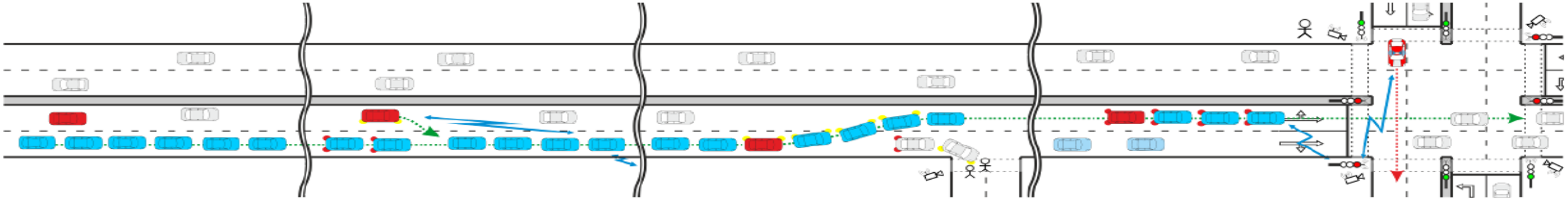
Two EU funded projects

- MAVEN (MG3.6a)
  - Managing Automated Vehicles Enhances Network
  - 01-09-2016 ~ 31-08-2019
  - Budget: EUR 3.149.661,25
  - Nine partners from five countries: DE, NL, CZ, BE, UK

- TransAID (ART-05)
  - Transition Areas for Infrastructure-Assisted Driving
  - 01-09-2017 ~ 31-08-2019
  - Budget: EUR 3.836.353,75
  - Seven partners from 6 countries: DE, UK, BE, NL, EL, ES

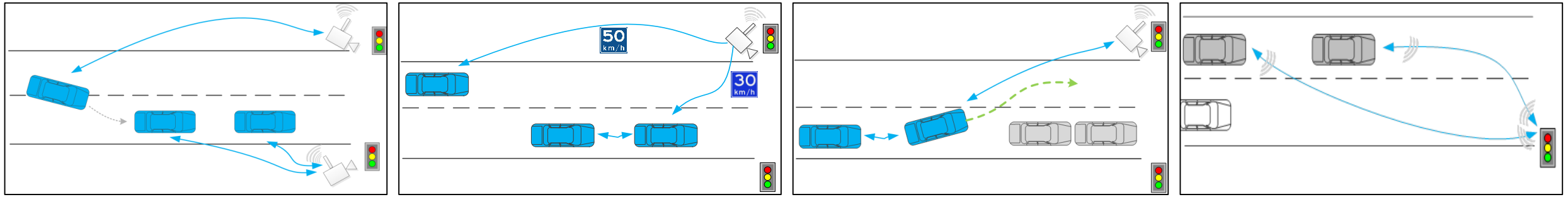
MAVEN objectives and scope

- MAVEN will develop **management regimes** for highly automated driving in **urban areas**.
- Road infrastructure will be able to **monitor, support and orchestrate** vehicle and VRU movements to guide highly automated vehicles at **signalized intersections** and corridors in urban areas.
- Beyond the state-of-the-art of ADAS and C-ITS services like GLOSA, by adding cooperative **platoon organization** and *signal plan negotiation* to **adaptive traffic light control algorithms**.
- Develop suitable enables technologies, e.g. **communication protocols**, and test and validate via simulation and real-world prototype (ITS-G5 based).

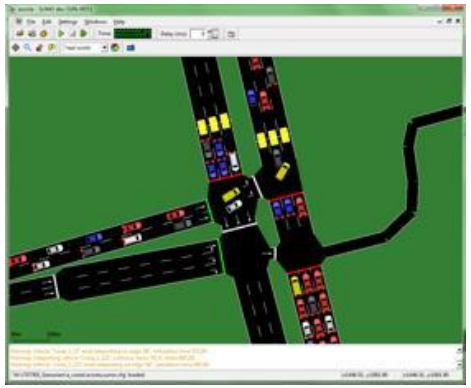


MAVEN use case overview

- I2V interactions
  - Negotiation (signal timing vs. arrival pattern), speed change advisory, lane change advisory
- Traffic controllers optimization
  - Signal optimization, priority management, queue estimation, green wave
- Platoon management
  - Forming, joining, travelling in, leaving, breaking a platoon
- Conventional traffic and VRUs
  - Detection of non-cooperative vehicles, VRUs, emergency situations

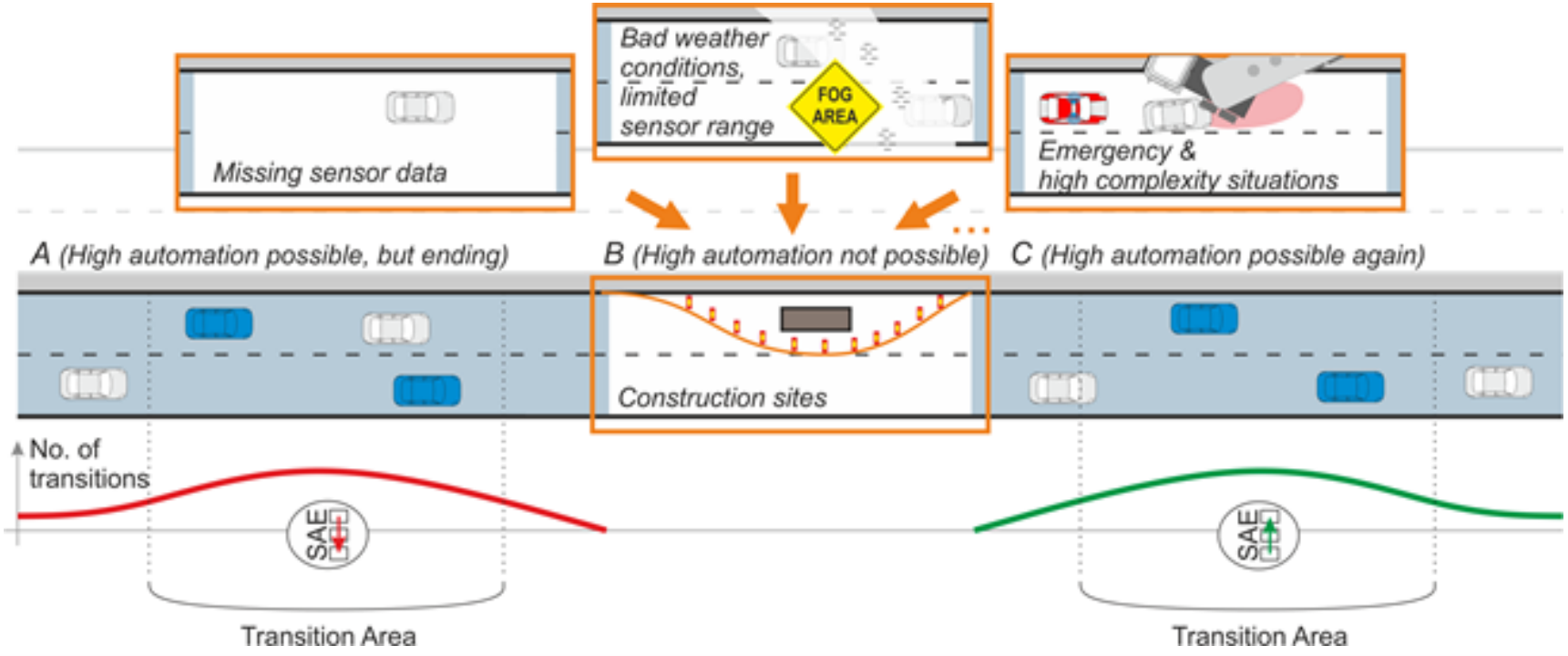


Project overview

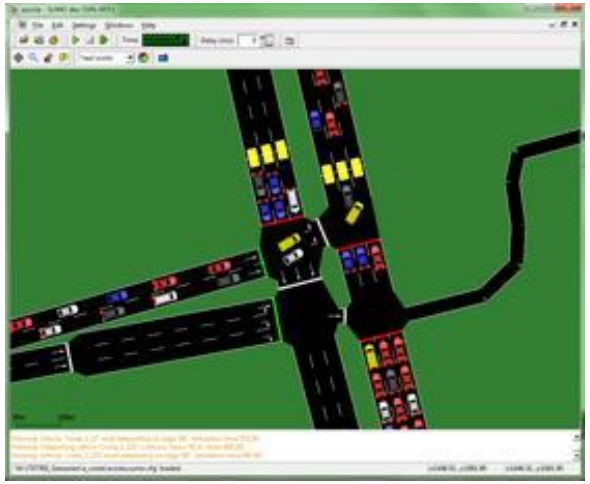


TransAID objective and scope

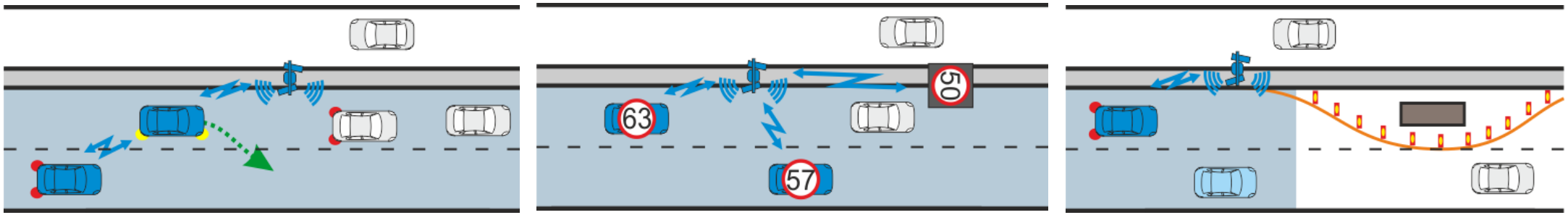
To develop and demonstrate **infrastructure-assisted** traffic management procedures, protocols and guidelines for smooth **coexistence** between automated, connected and conventional vehicles especially at **Transition Areas**.



TransAID scenarios



- And possible TM interventions
  - Transition to higher levels of automation
  - Lane changes
  - Speed changes
  - Intersection pilot (MAVEN)
  - Traffic separation
  - Transition to lower levels of automation
- Application area: Truck Platooning near merging-sections



V2X communication protocols

Candidate extensions

- Fundaments:
  - Based on common distributed algorithm and V2V exchanged info, individual vehicles form platoons and manage their operation (joining, leaving, etc.).
  - Yet, platoon leader has the central role of communicating platoon properties to the infra.
  - *Two-channel approach to be decided: one for announcements, the other for control and management interaction.*

- Cooperative Awareness Message (CAM)
  - Planned manoevre at intersection; Desired speed range; Platoon identifier, status and properties (size, length, roles, speed, headway, composition, etc.); Acknowledgments of intentions and compliance
- Signal Phase and Timing Message (SPAT)
  - Differentiated speed advisory; Lane advisory; Desired headway; Maximum platoon lenght; Prohibitions such as platooning or level of automated driving.
- Cooperative sensing
  - Detected non-cooperative road users, vulnerable road user in particular

In summary

- Infra-assistance for highly automated driving
  - Managing Automated Vehicles Enhances Network
  - Transition Areas for Infrastructure-Assisted Driving
- A necessity and new ways/functions of Traffic Management
- Many ideas and concepts, equal amount of questions: much to research!
- Much interest from (loca) road authorities, in particular in the broader city mobility context

Thank you for listening!

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