C-ROADS

9 years of C-ITS operations in Europe

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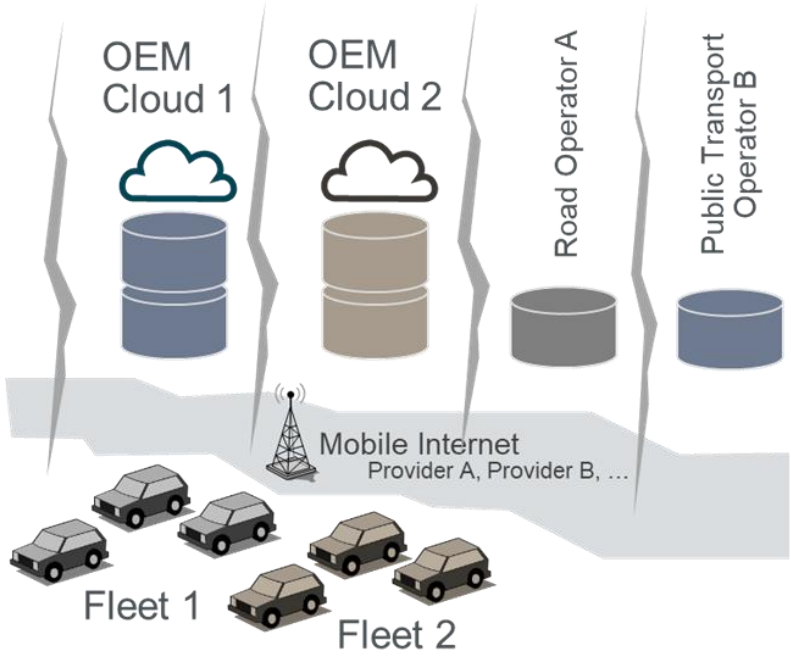
Cooperative ITS (C-ITS)

- In Europe
  - Wide scale C-ITS deployments are ongoing
  - Operation of C-ITS-services along first motorways and in front-running cities are reality

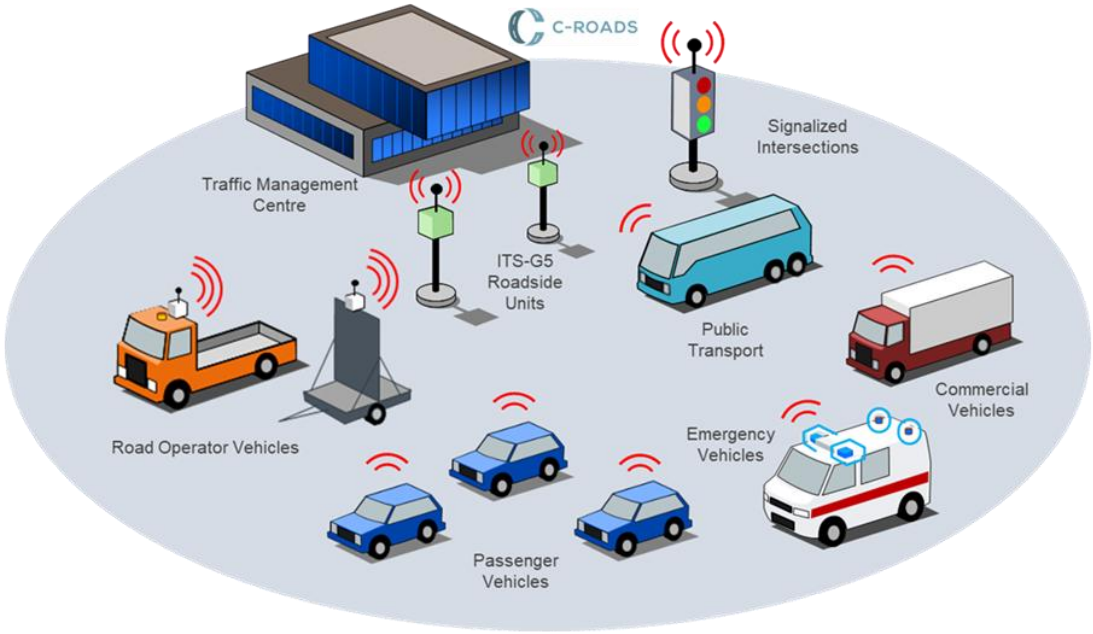
- Without cooperation, that would not have happened
  - Cooperation between authorities and road operators => C-Roads
  - Cooperation with the car-industry
  - Cooperation with the JRC

- The European C-Roads Platform
  - Links all C-ITS deployment activities
  - Works on harmonised specifications
  - Performs cross-testing

C-Roads – a cooperative approach



- Non-cooperative systems (traditional ITS) often tends towards silos
- Data exchange is not guaranteed



- In cooperative systems (C-ITS) all participants use the same system
- VANET communication is decentralised, robust and resilient

Cooperative ITS (C-ITS)

EU Directive 2010/40/EU amended by EU Directive 2023/2661:

"cooperative intelligent transport systems" or "C-ITS" means intelligent transport systems that enable ITS users to interact and cooperate by **exchanging secured and trusted messages, without any prior knowledge** of each other and in a non-discriminatory manner

- Covers all vehicle types and users (public transport, VRUs, bicycles, road workers…)
- Includes RSUs and central infrastructure elements
- Based on security mechanisms as defined by EU certification

=> Setup of a European C-ITS Ecosystem

=> supports basic SRTI needs as well as advanced safety and ADAS use-cases

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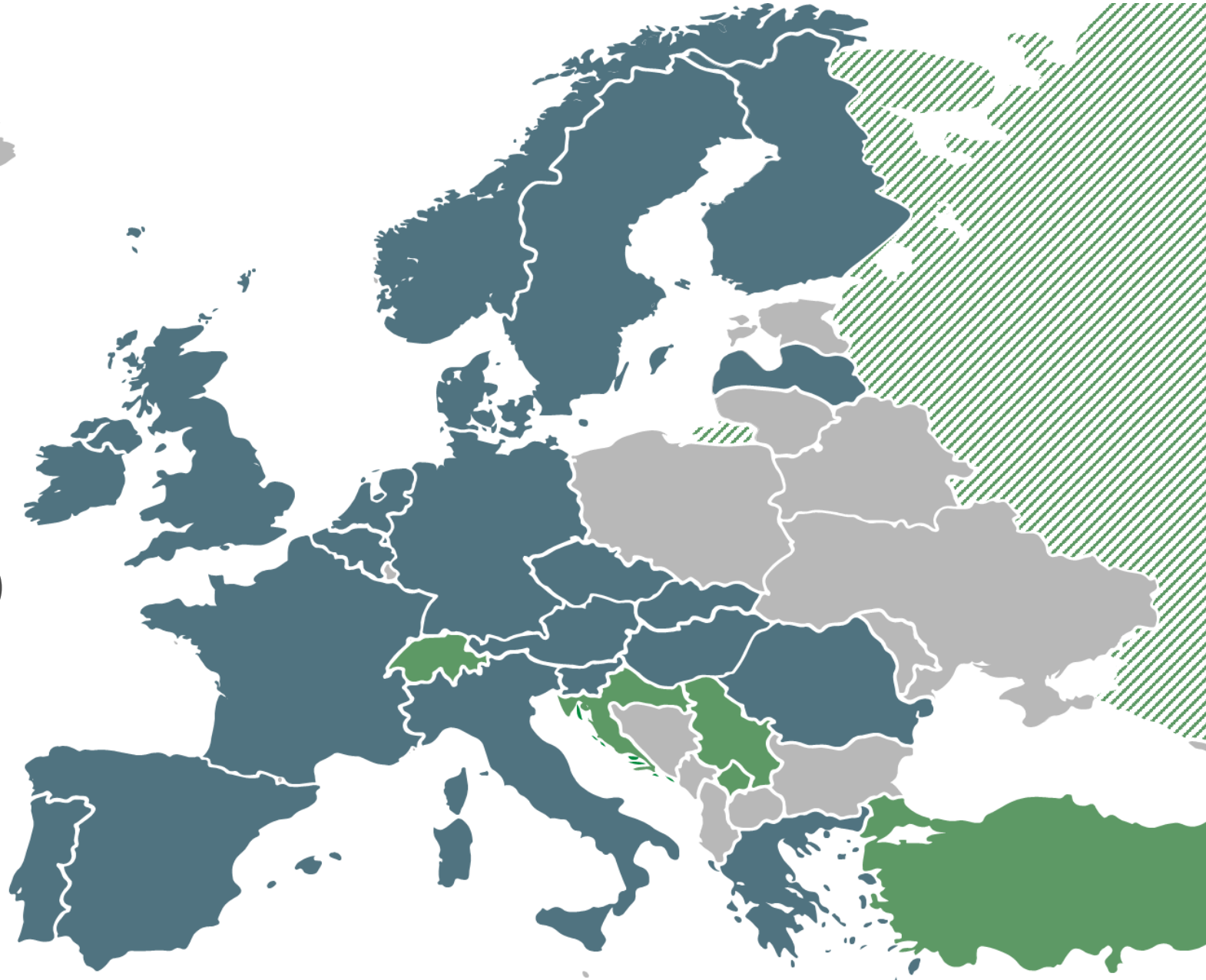
C-Roads

21 European countries

> 50 European cities

- ~ 3.000 RSUs are deployed all across Europe
- ~ 2.500 OBUs are deployed (Public Transport vehicles, blue- and yellow light service vehicles)
- 2.5 M of vehicles are C-ITS equipped
- Start with operation of C-ITS brokers (IP based C-ITS)



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Short Range Communication (ETSI ITS-G5)

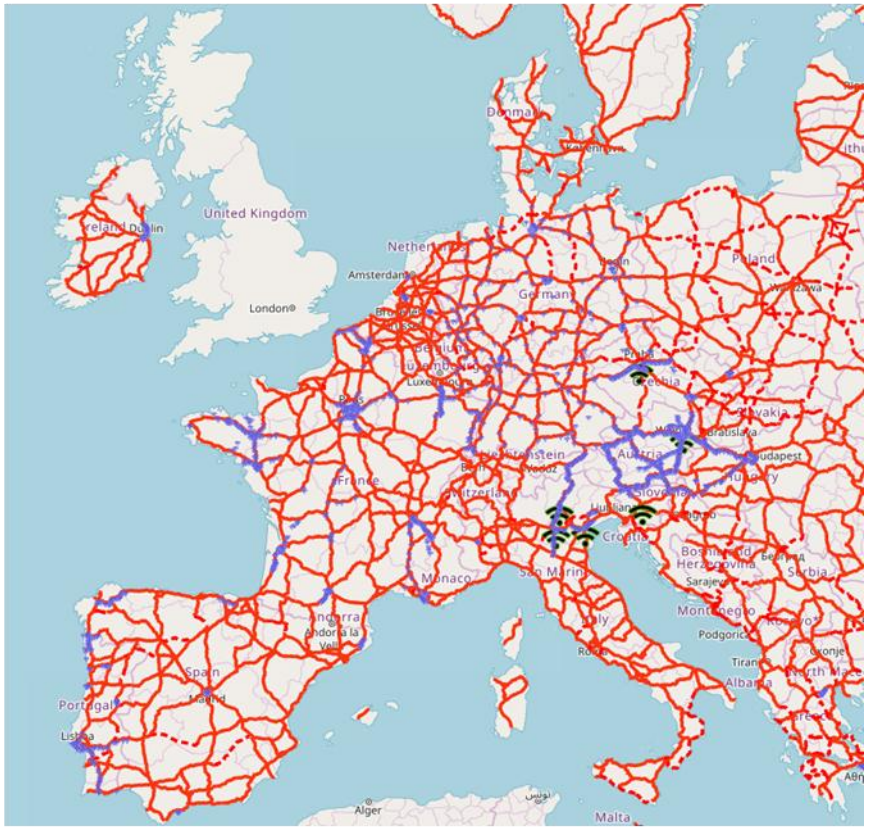
STATUS	installed
ROAD_NAME	A02
RSU_OWNER	ASFINAG
COUNTRY	Austria
SECURITY	Yes
HLN_AZ	Yes
HLN_TJA	Yes

Zoom to 1 of 2

Cellular based Communication

COUNTRY	SI
HLN_AZ	Yes
HLN_TJA	Yes
HLN_WCW	Yes
HLN_TSR	Yes
HLN_OR	Yes
RWW_LC	Yes

Zoom to



https://webgate.ec.europa.eu/tentec-maps/web/public/screen/home

European C-Roads Platform

Phase 1
2016 – 2019

Initial phase

Focus on Specifications and piloting along motorways

Phase 2
2020 – 2024

Motorway phase

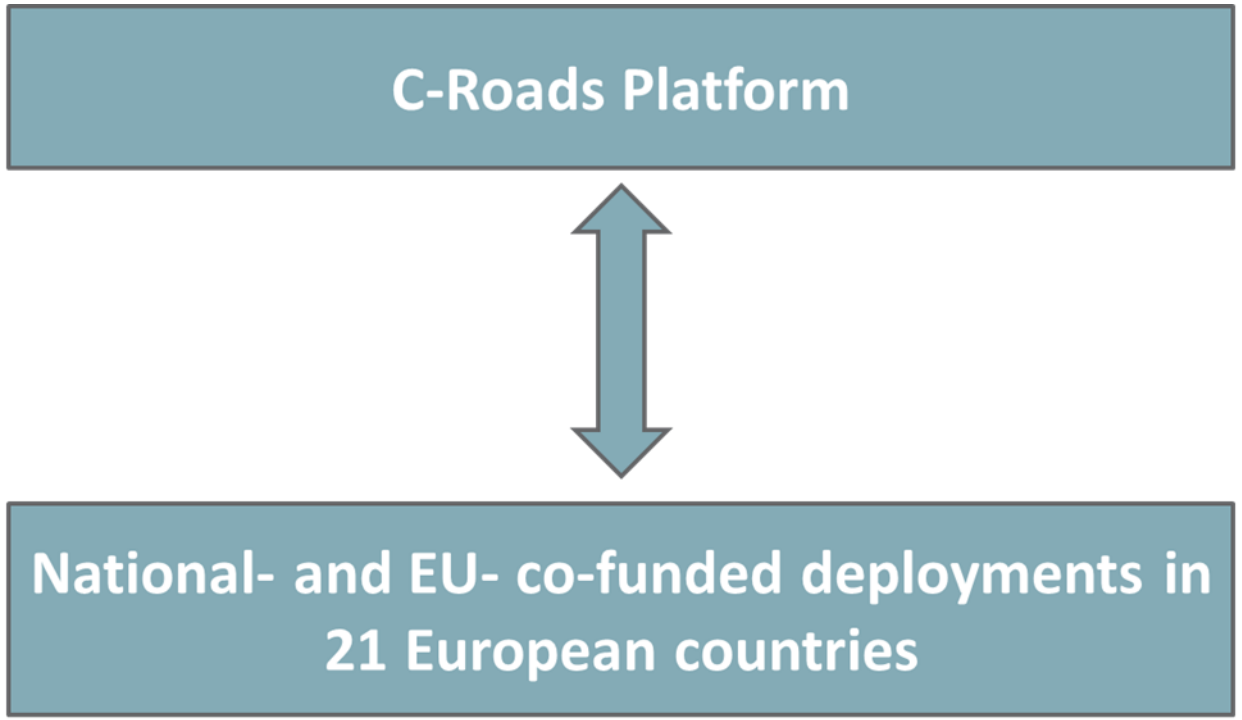
Focus on deployments along motorways and urban pilots

Phase 3
2024 –

Urban phase

Focus on operations along motorways, urban deployments and integration of new stakeholders

European C-Roads Platform

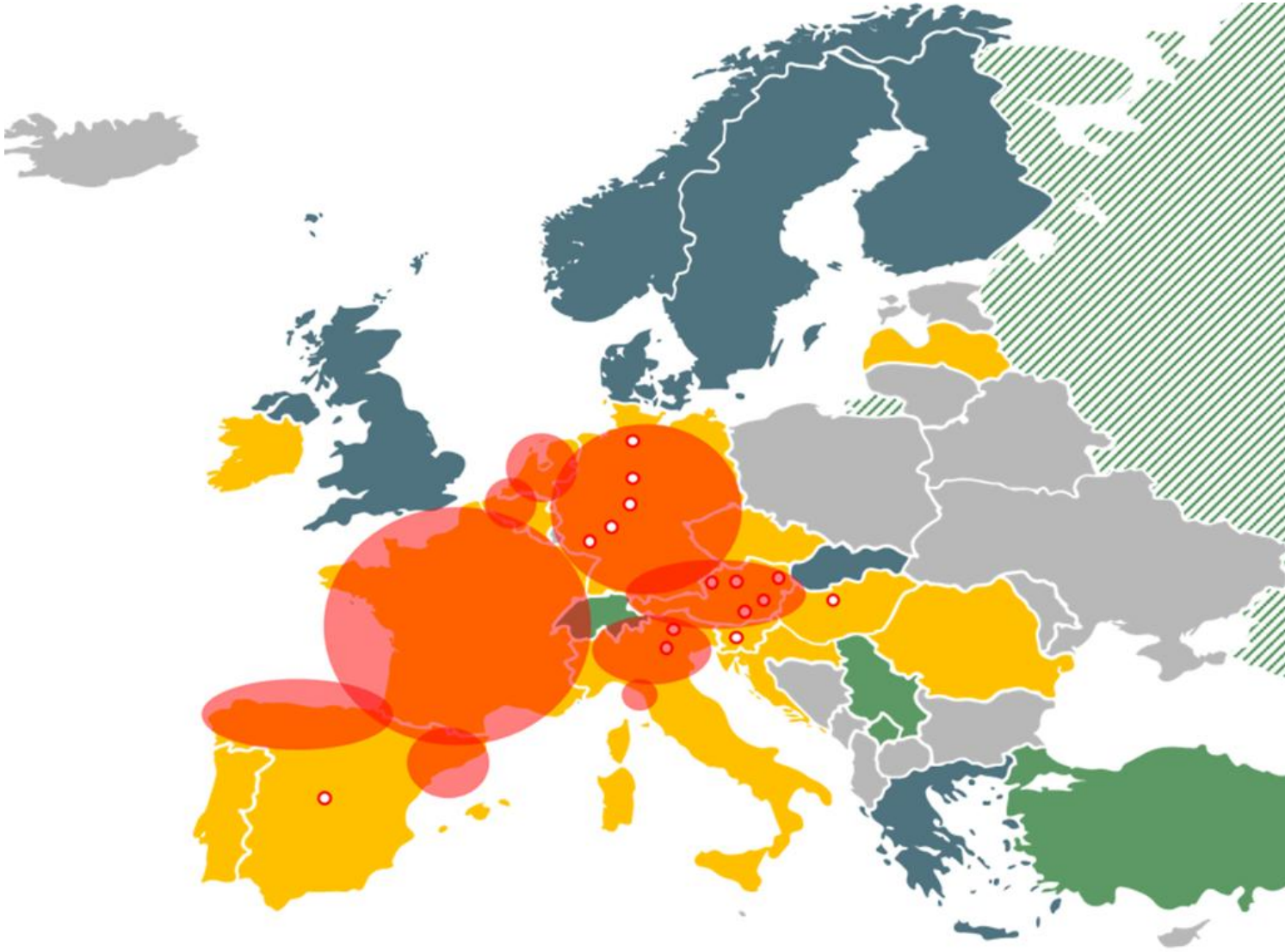


- Chaired by 21 state-representatives
- Link all C-ITS deployment activities
- Work on harmonised specifications (https://releases.c-roads.eu/)
- Perform cross-testing
- Hybrid communication mix

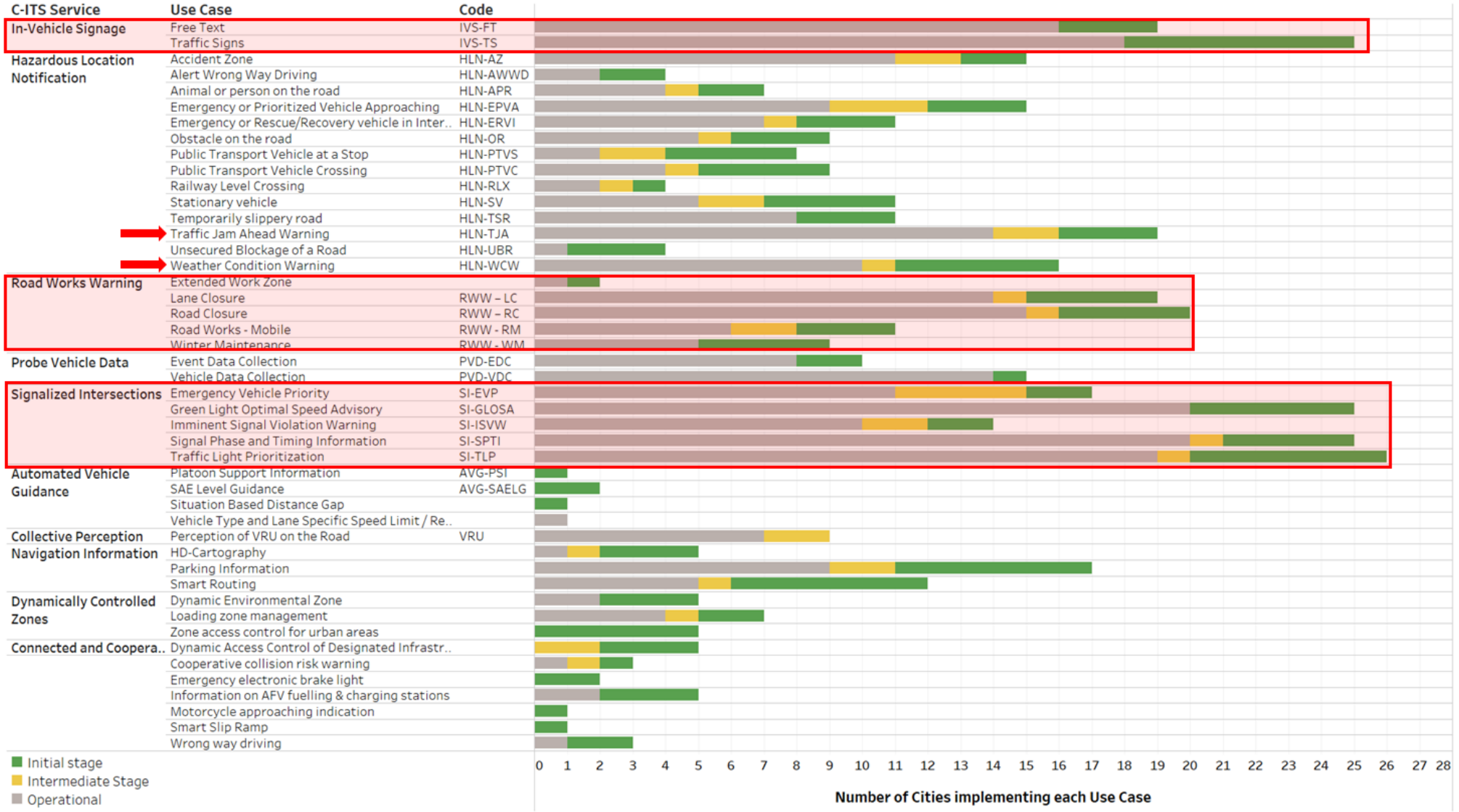
- Contribute to C-Roads expert groups
- Bring in knowledge from own deployments
- 500 M € EU co-funding (since 2015)
- 500 M € national co-funding
- Additional national deployments

C-Roads

- C-Roads specifications are based on real deployments
- 500 M € EU co-funding (since 2015)
- 500 M € national co-funding
- Additional national and local deployments



Urban C-ITS use cases



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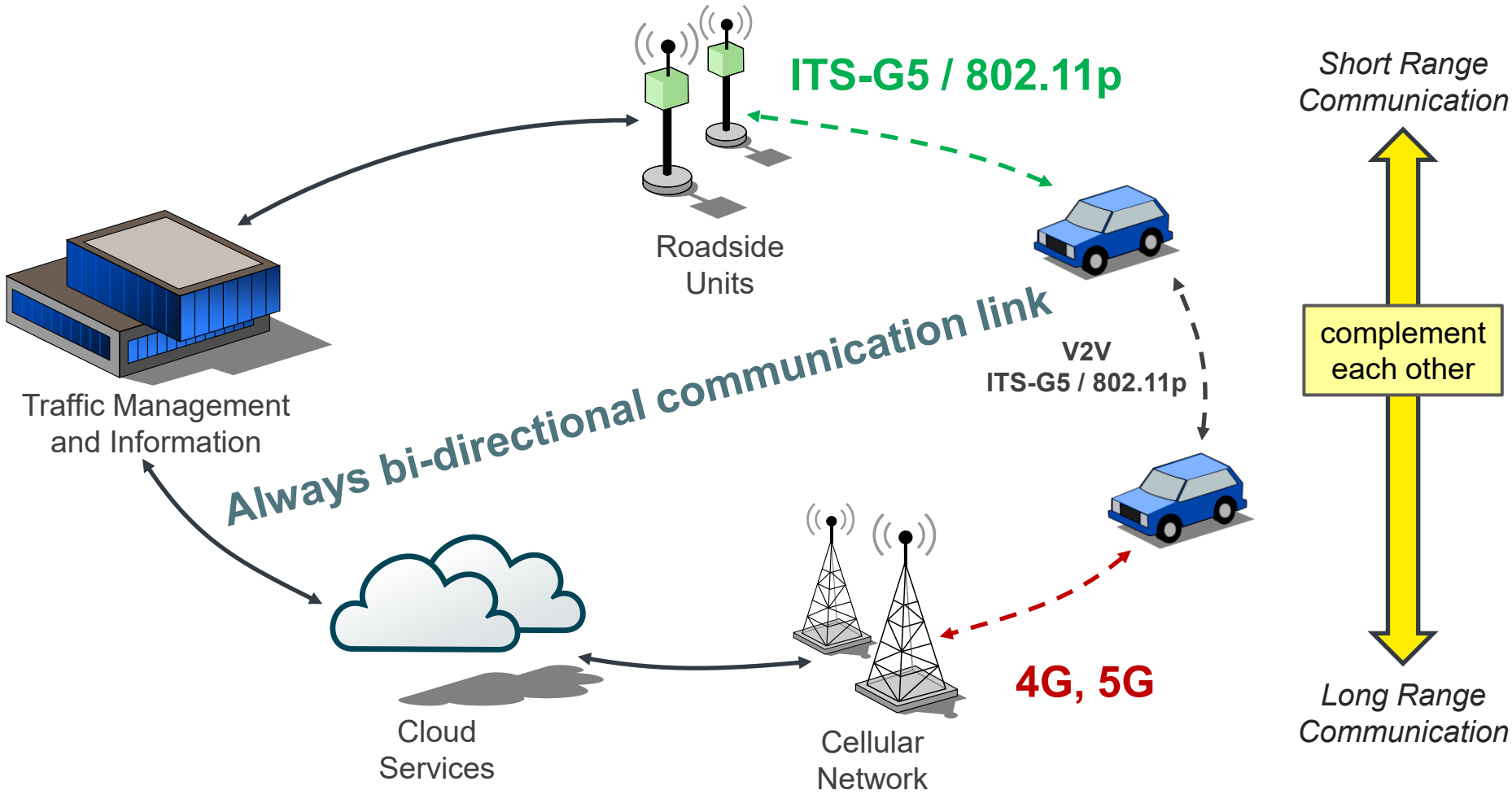
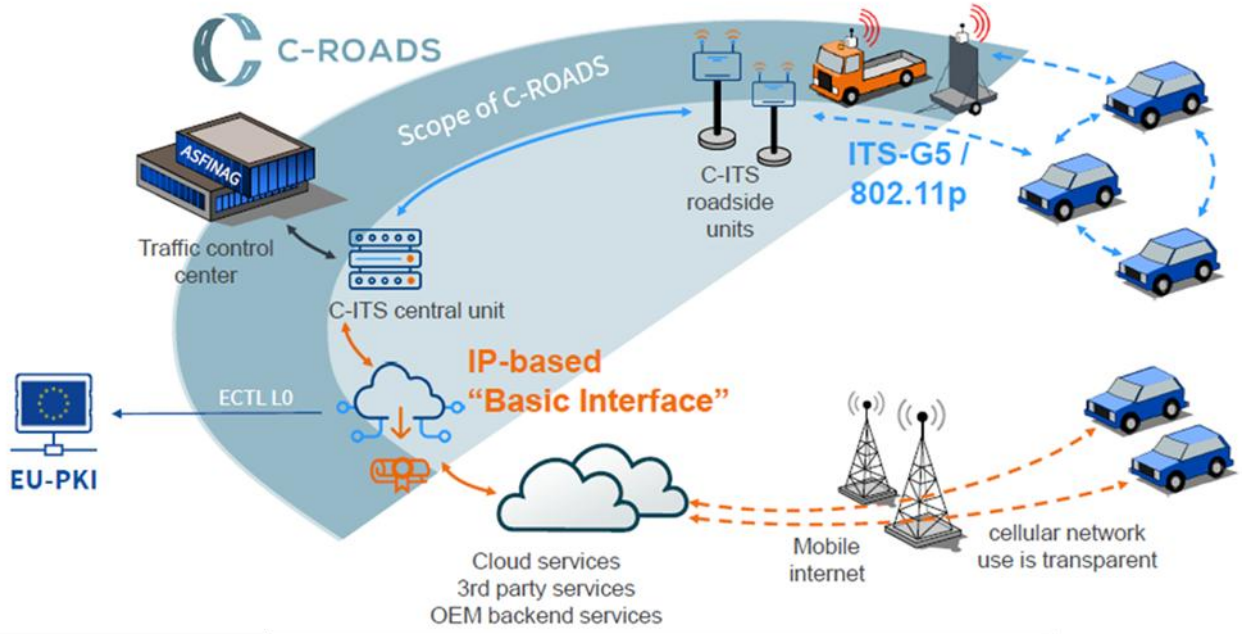
C-ITS based on a hybrid communication mix…

Short and long range communication complement each other:



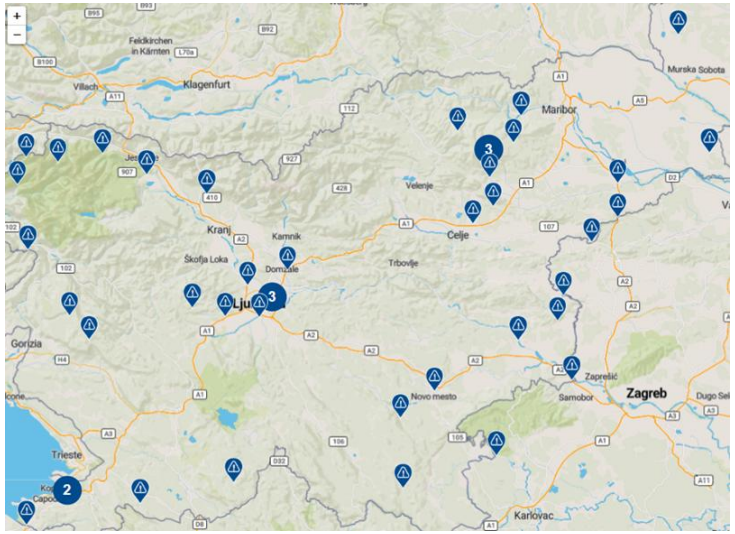
C-Roads IP based C-ITS

- AMQP based server implemented (=**C-ITS Broker)**
- “Hybrid” communication: C-ITS messages ar broadcast locally via direct communication and are published on the C-ITS Broker → **same messages**
- C-ITS messages are delivered with the **same message ID for the same traffic event** via all used communication channels to the user and contain a **security header** for authenticit and trust
- Millions of messages already exchanged between active participants of IP-based C-ITS



Active C-ITS Brokers implemented

- AUSTRIA
- CZECH REPUBLIC
- FRANCE
- ITALY
- NORWAY
- SLOVENIA
- SPAIN
- SWEDEN



The benefit of C-ITS Brokers

C-ITS Brokers are needed to

- Provide access to C-ITS messages to users (e.g. OEMs)
- Link areas of C-ITS service operation (e.g. exchange services between different regions)
- Vision Austria:
  - All C-ITS infrastructure operators (including cities like Graz, Salzburg, or Vienna as well as the motorway operator ASFINAG) are linked to the Austrian C-ITS Broker to provide access to messages of the neighbouring infrastructure
  - In this way the motorway operator can already inform travellers about events on the urban infrastructure and vice versa.

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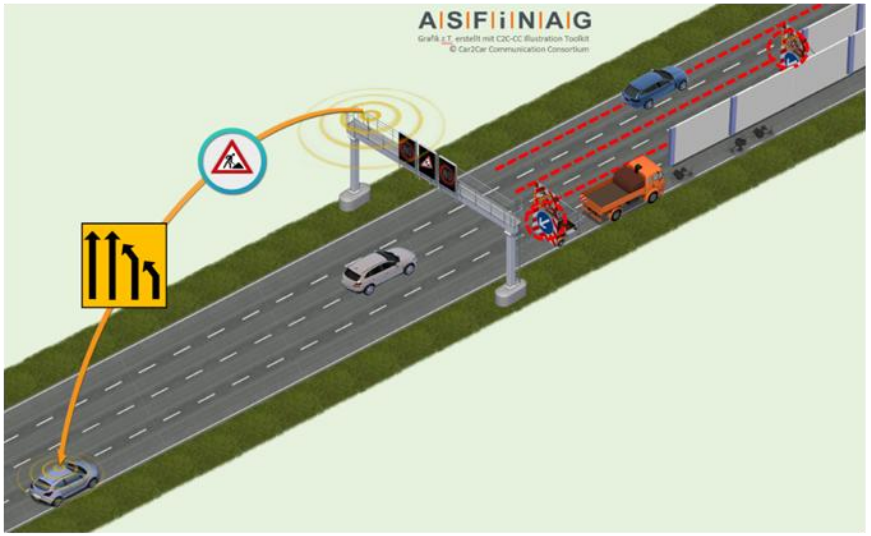
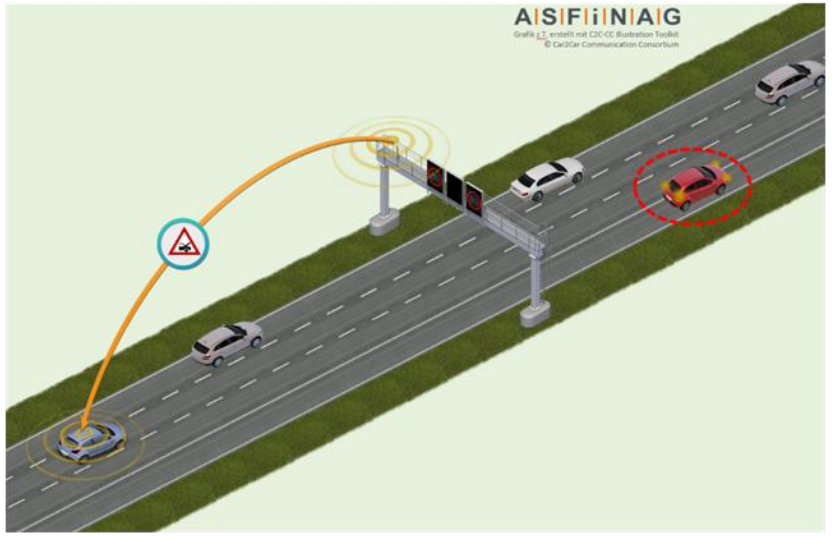
Road Works Warning
Digital warnings



C-ITS Road Works Warning in Volkswagen ID.7

Hazardous Location Notification
Digital hazard warnings

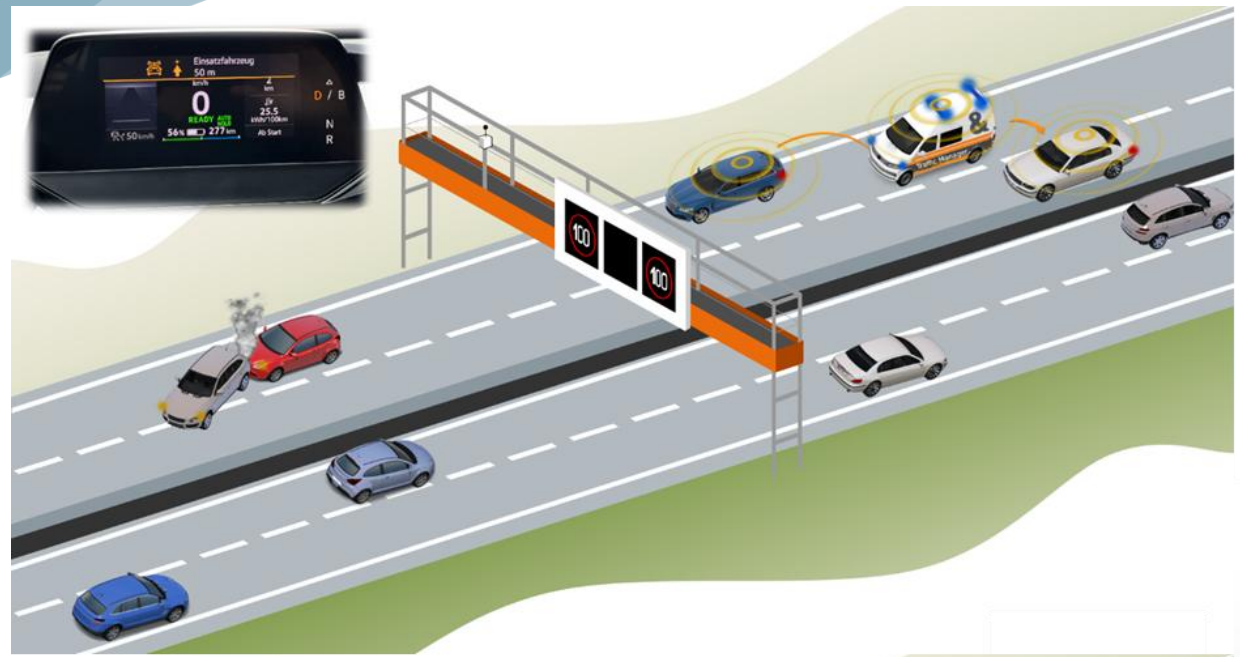


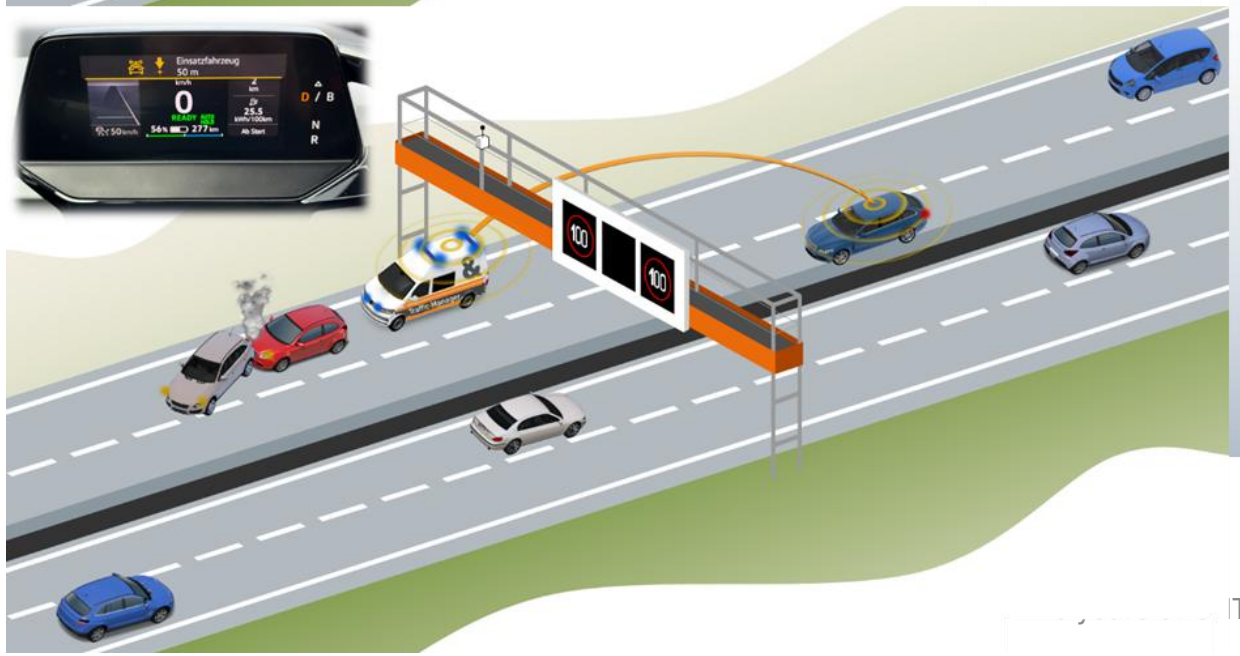
C-ITS Accident Warning in Volkswagen ID.7

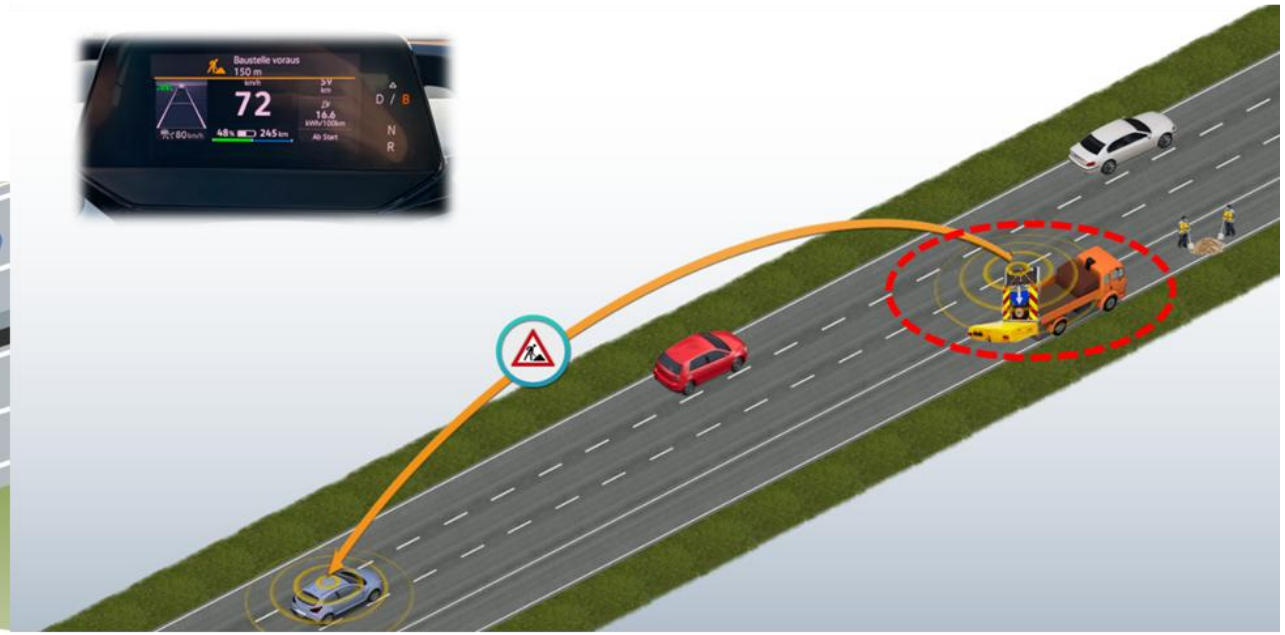
In-Vehicle Signage
Digital traffic signs

Source: „Car2X at Volkswagen – The next Steps“, Car2Car Week, 2023

Emergency vehicle approaching
Emergency vehicle in intervention
Roadworks warning
Slow vehicle

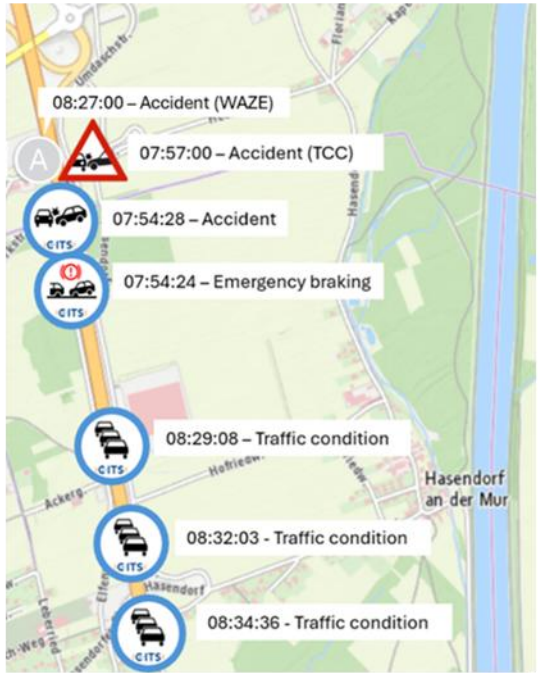




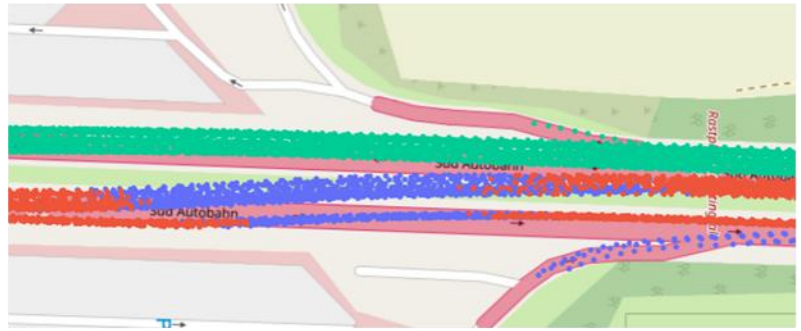


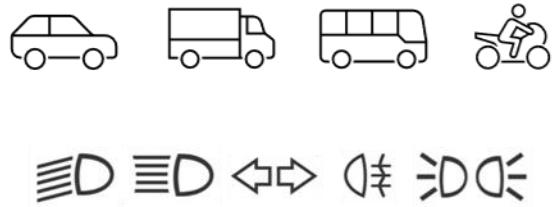
Travel Time
benefit for customers

Vehicle Events
benefit for road operator & customer



Probe Vehicle Data (PVD)
improvement of traffic management





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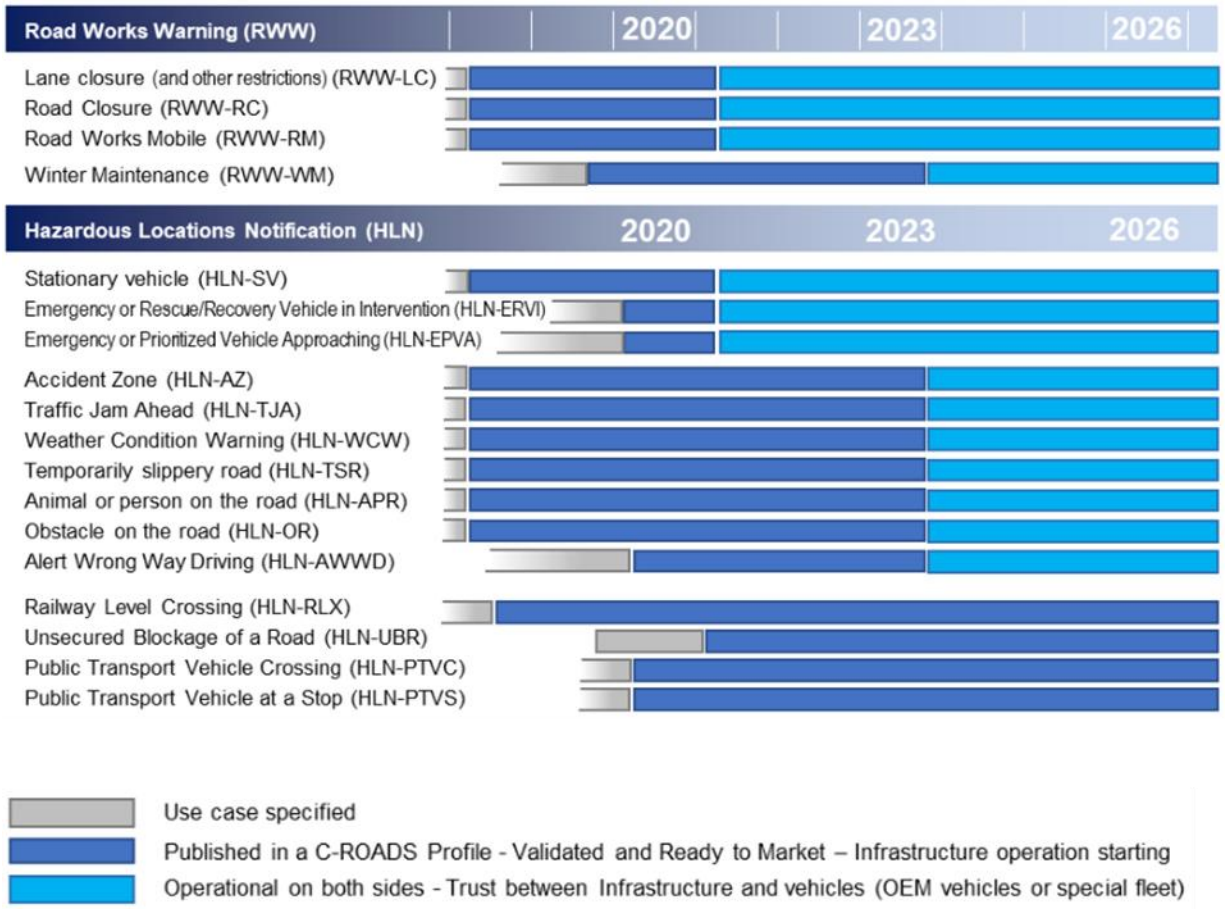
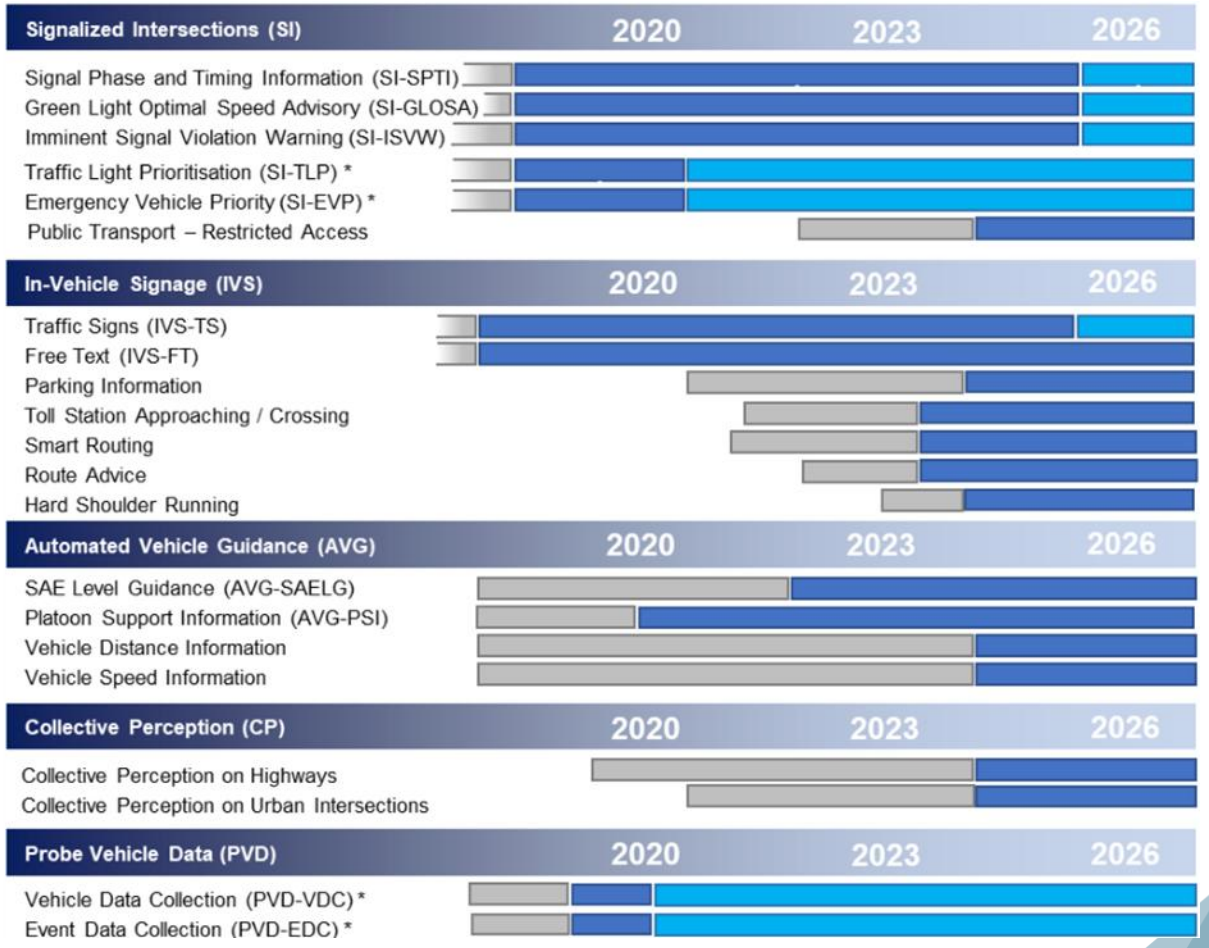
C-ITS use cases





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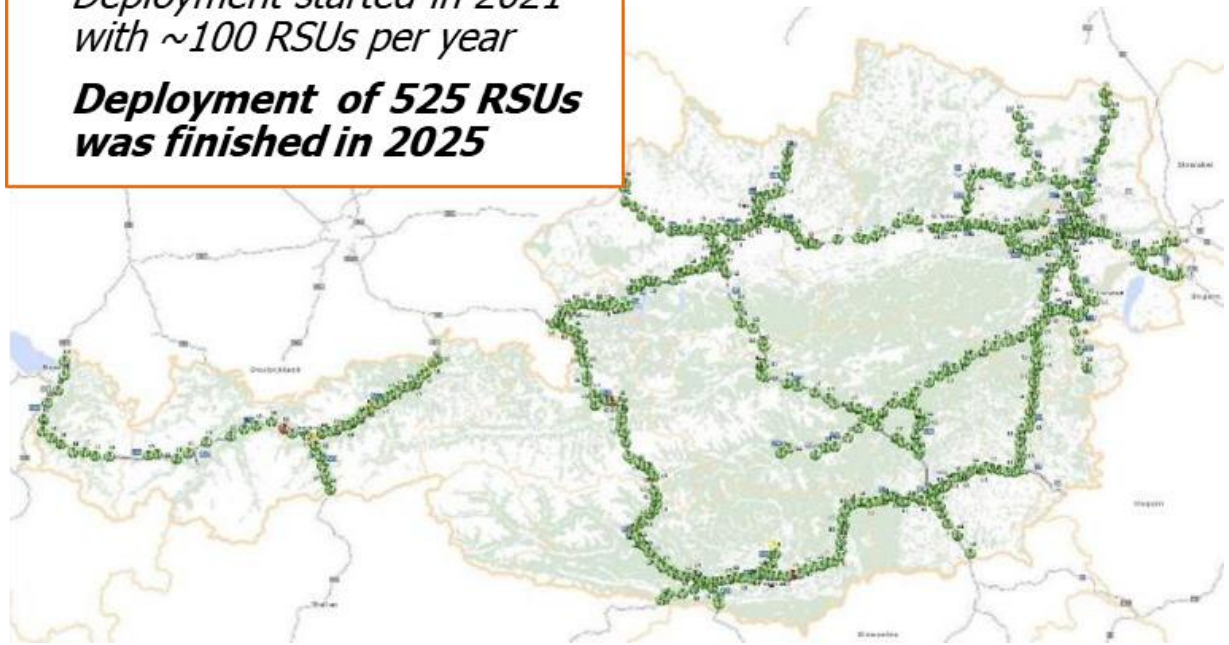
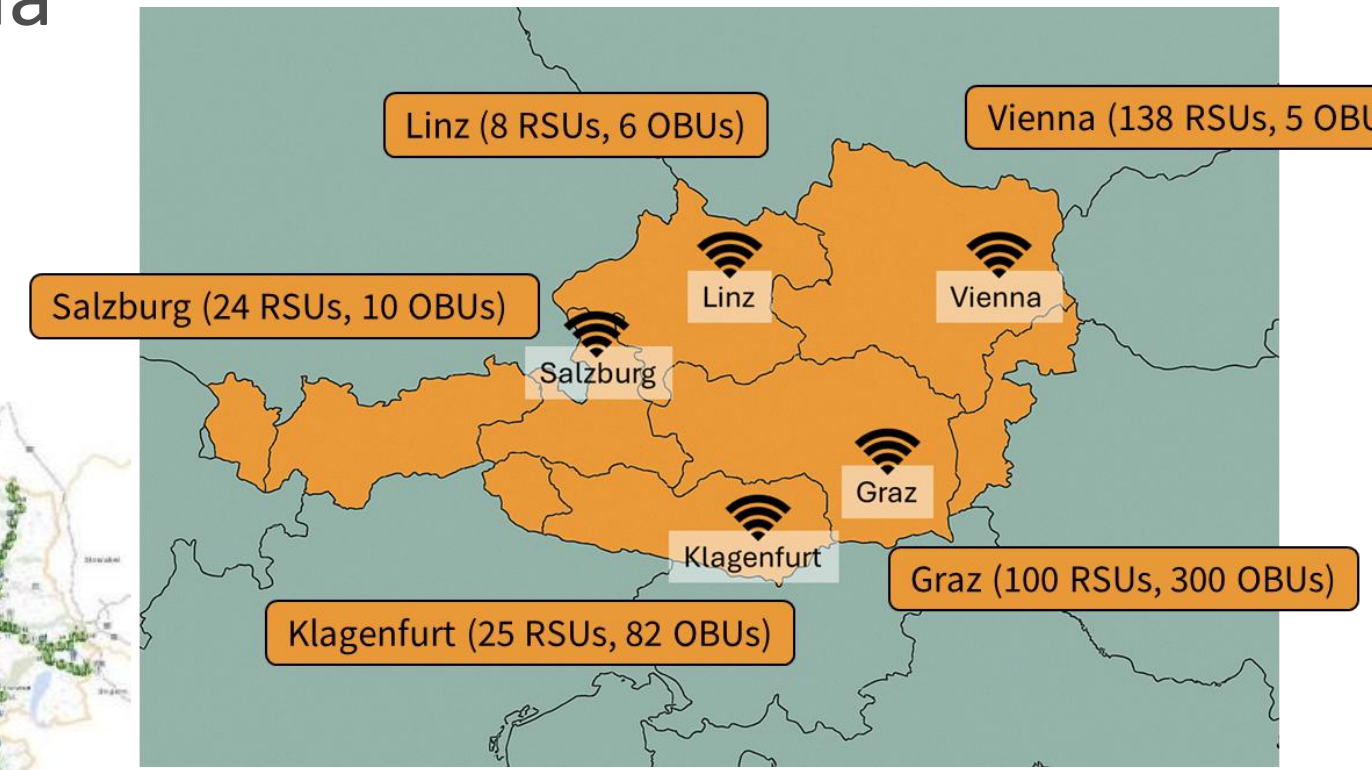
Deployment status Austria

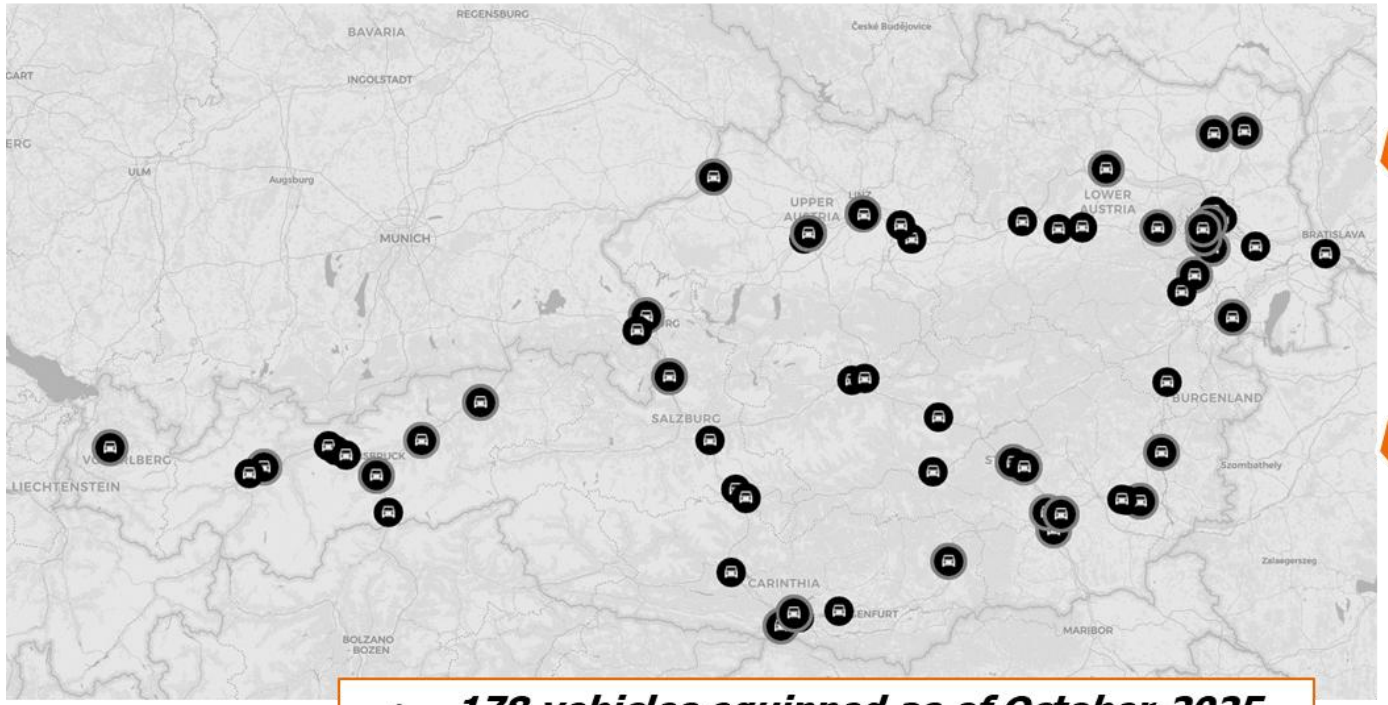
Deployment started in 2021 with ~100 RSUs per year

Deployment of 525 RSUs was finished in 2025





Deployment status Austria



- ***178 vehicles equipped as of October 2025***
- *Another 12 units planned in 2025*
- *Final roll-out: ~230 units*

Road Maintenance

Tolling Enforcement

Traffic Manager

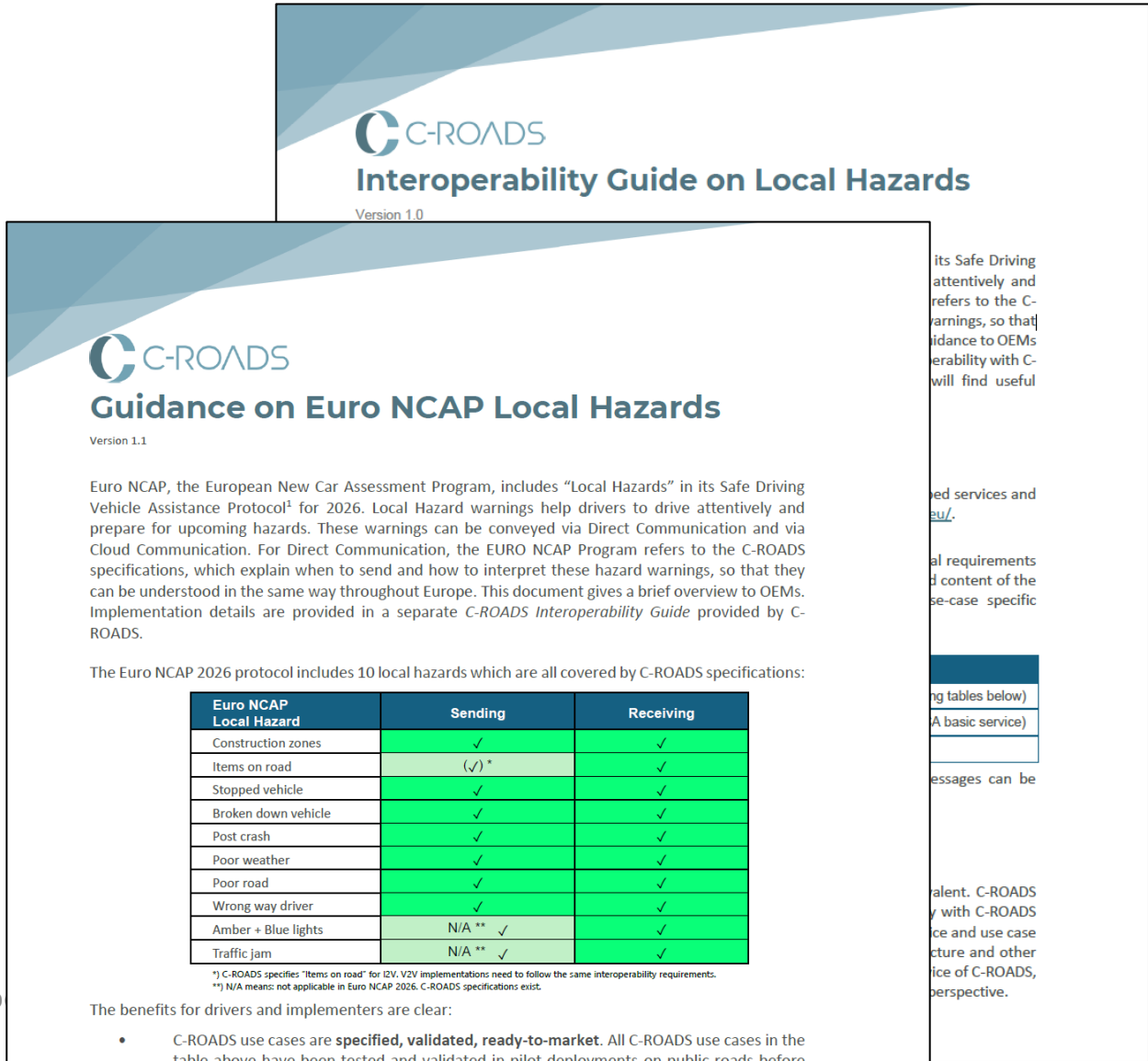
Traffic Manager Bikes

Traffic Cone Setters

Attenuators

Euro-NCAP

- C-ITS is part of „Speed Assistance Systems – Local Hazards“.
- long- and short-range services are listed – C-Roads is mentioned at the short-range services.
- This is the starting point for the „2026 protocol“. Further additions of C-ITS will be discussed in the Euro NCAP Safe Driving category 2029
- C-Roads has published supporting documents



C-ROADS

Interoperability Guide on Local Hazards

Version 1.0

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C-ROADS

Guidance on Euro NCAP Local Hazards

Version 1.1

Euro NCAP, the European New Car Assessment Program, includes “Local Hazards” in its Safe Driving Vehicle Assistance Protocol[1] for 2026. Local Hazard warnings help drivers to drive attentively and prepare for upcoming hazards. These warnings can be conveyed via Direct Communication and via Cloud Communication. For Direct Communication, the EURO NCAP Program refers to the C-ROADS specifications, which explain when to send and how to interpret these hazard warnings, so that they can be understood in the same way throughout Europe. This document gives a brief overview to OEMs. Implementation details are provided in a separate *C-ROADS Interoperability Guide* provided by C-ROADS.

The Euro NCAP 2026 protocol includes 10 local hazards which are all covered by C-ROADS specifications:

Euro NCAP Local Hazard	Sending	Receiving
Construction zones	✓	✓
Items on road	(✓) *	✓
Stopped vehicle	✓	✓
Broken down vehicle	✓	✓
Post crash	✓	✓
Poor weather	✓	✓
Poor road	✓	✓
Wrong way driver	✓	✓
Amber + Blue lights	N/A ** ✓	✓
Traffic jam	N/A ** ✓	✓

*) C-ROADS specifies "Items on road" for I2V. V2V implementations need to follow the same interoperability requirements.
**) N/A means: not applicable in Euro NCAP 2026. C-ROADS specifications exist.

The benefits for drivers and implementers are clear:

- C-ROADS use cases are **specified, validated, ready-to-market**. All C-ROADS use cases in the

Conclusion

- **Safety related services via C-ITS are a reality today**: Harmonised specifications and quality criteria are in place
- a **multi-channel distribution mechanism** has been established and is already distributing millions of messages bidirectional
- The **European C-ITS ecosystem** for safety related data exchange uses **standardised message formats** as well as already EU-wide harmonized specifications and interfaces from C-Roads
- Exchanging data between all committed actors (**bidirectional**) in accordance with the European ITS-Directive
- Incorporates the notion of **„trust“** (EU Trust Domain)

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Let‘s connect

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