

ITSDANMARK ÅRSMØDE 2025

C-ITS Deployment in Austria



An overview about the operational C-ITS deployment on Austria's motorway network and in Austria's cities, with further reflections on the overall benefits of C-ITS for infrastructure providers, urban and inter-urban

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Program Manager C-ITS

A|S|F|i|N|A|G

HAVE A SAFE TRIP, AUSTRIA!



~3,230
Employees

6
Toll stations

9
Traffic management centres

32.65 BILLION

km of total traffic per year

2,266

kilometres of road network

44

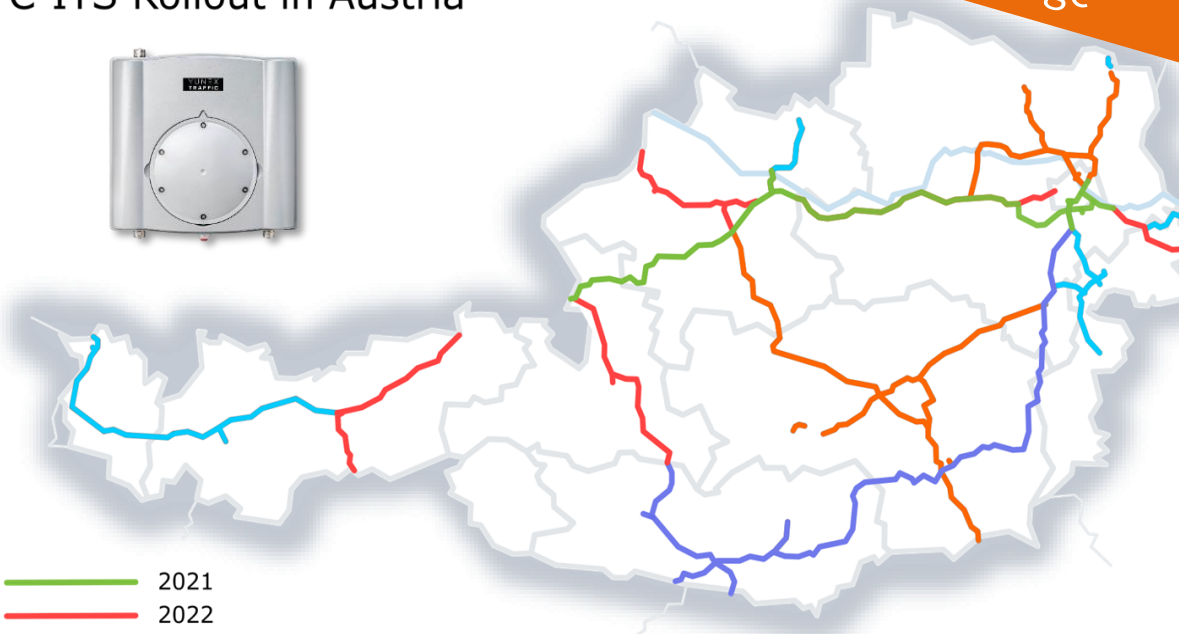
Motorway operation and maintenance facilities

MISSION C-ITS: ROADSIDE DEPLOYMENT

C-ITS Rollout in Austria

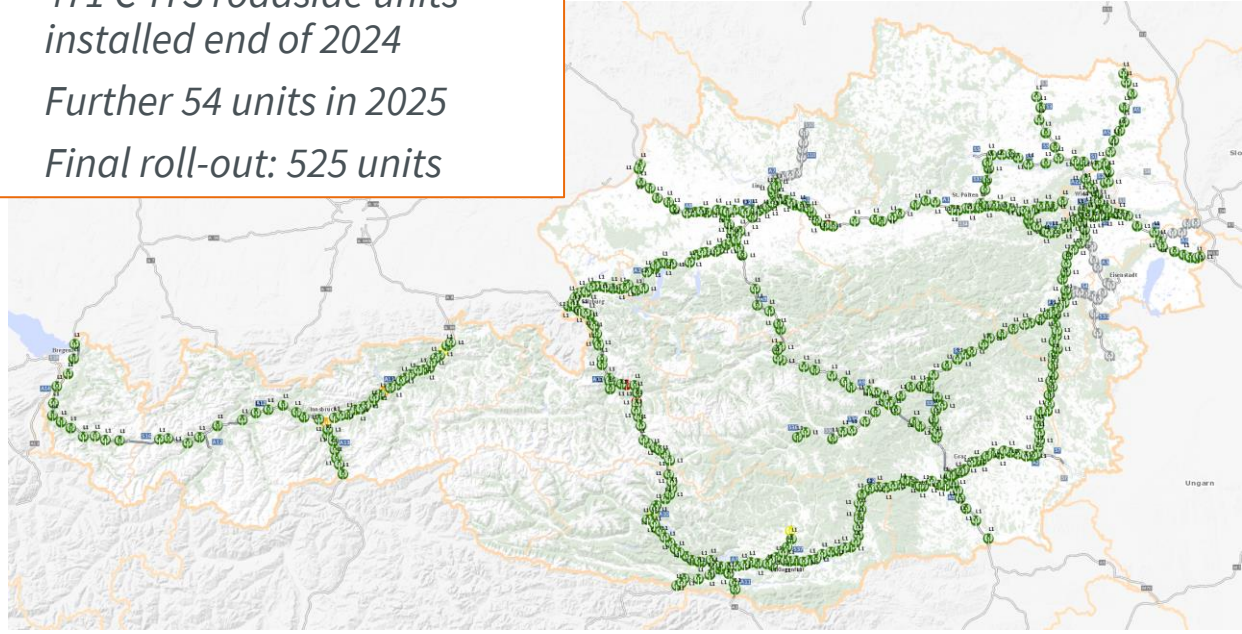


One C-ITS roadside unit every 4 km on average



- 2021
- 2022
- 2023
- 2024
- 2025

- 471 C-ITS roadside units installed end of 2024
- Further 54 units in 2025
- Final roll-out: 525 units



Co-financed by the Connecting Europe Facility of the European Union

- Grant agreements:
- No 1136268 (C-ROADS Austria)
 - No 1798498 (C-ROADS Austria 2)
 - No 101078925 (C-ROADS Austria 3)

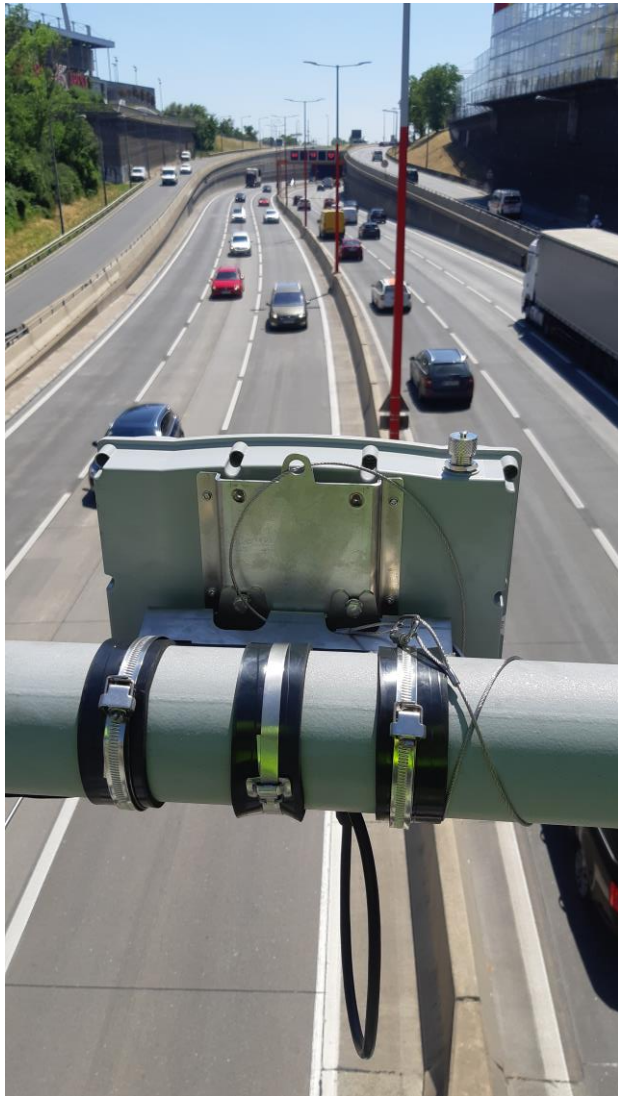


CAR 2 CAR
COMMUNICATION CONSORTIUM



„ASFINAG Mission C-ITS“ video:
<https://youtu.be/g0Zrp1BBBw>

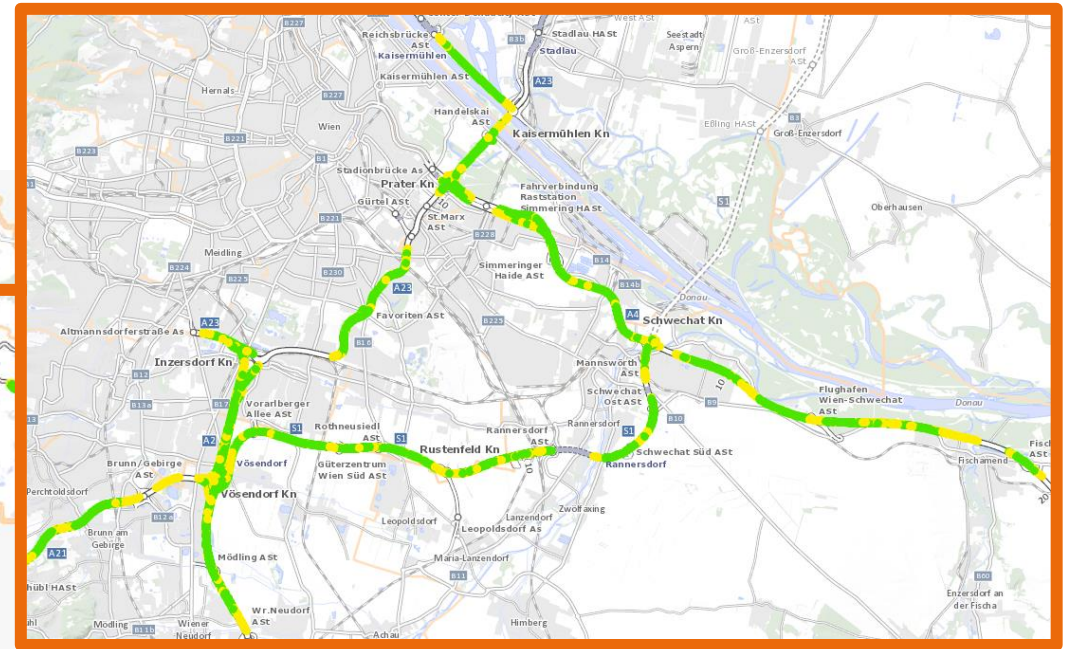
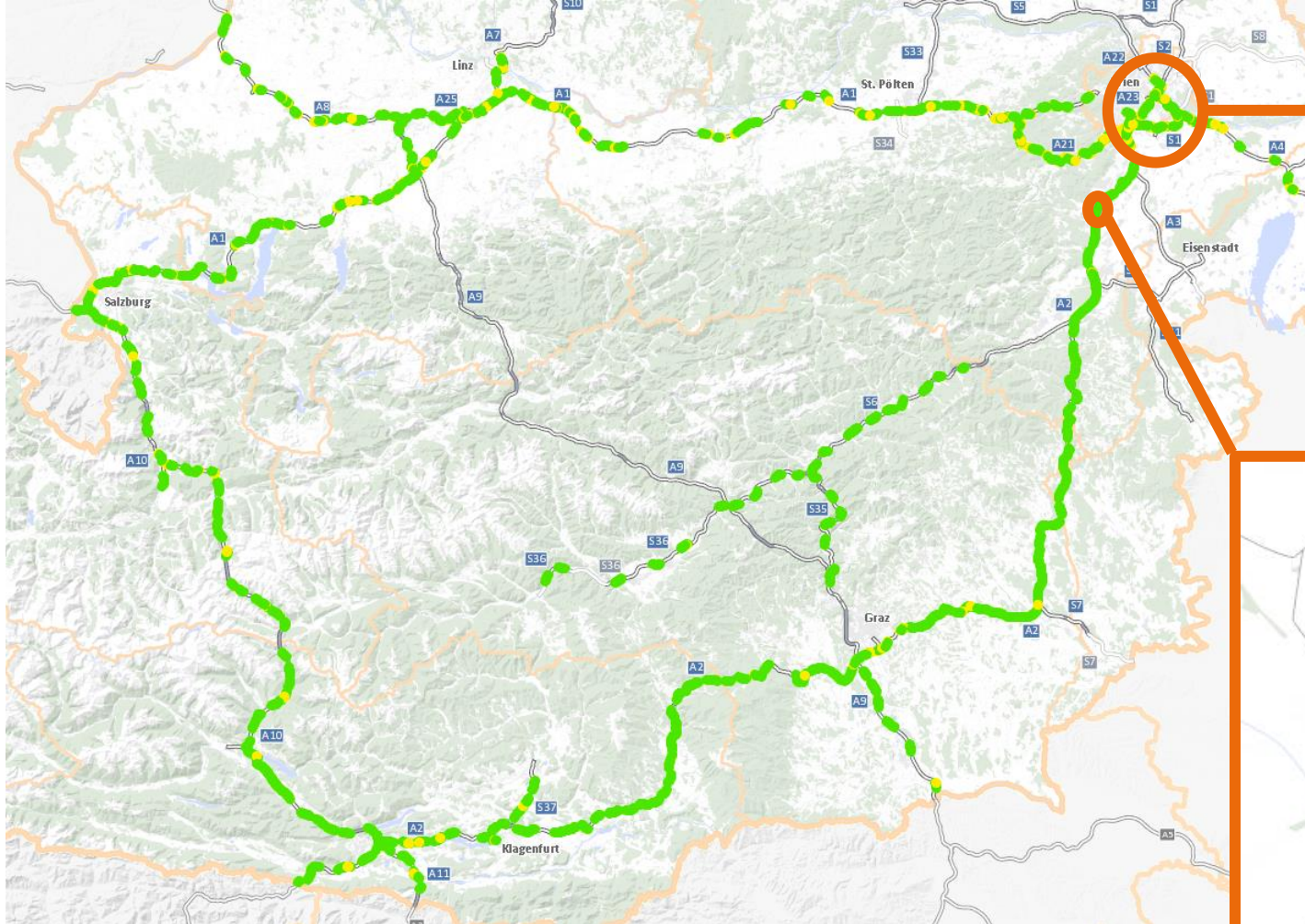
ROADSIDE UNITS MOUNTED ON VMS GANTRIES



ROADSIDE UNITS MOUNTED EVERYWHERE ELSE




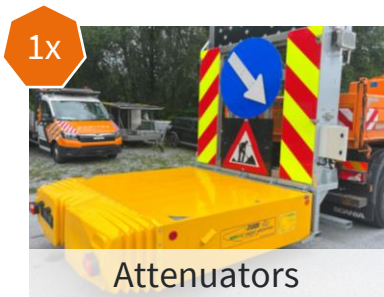
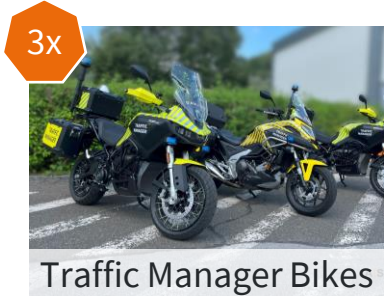
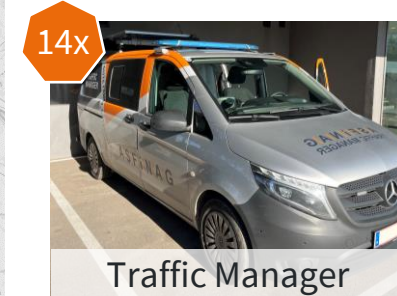
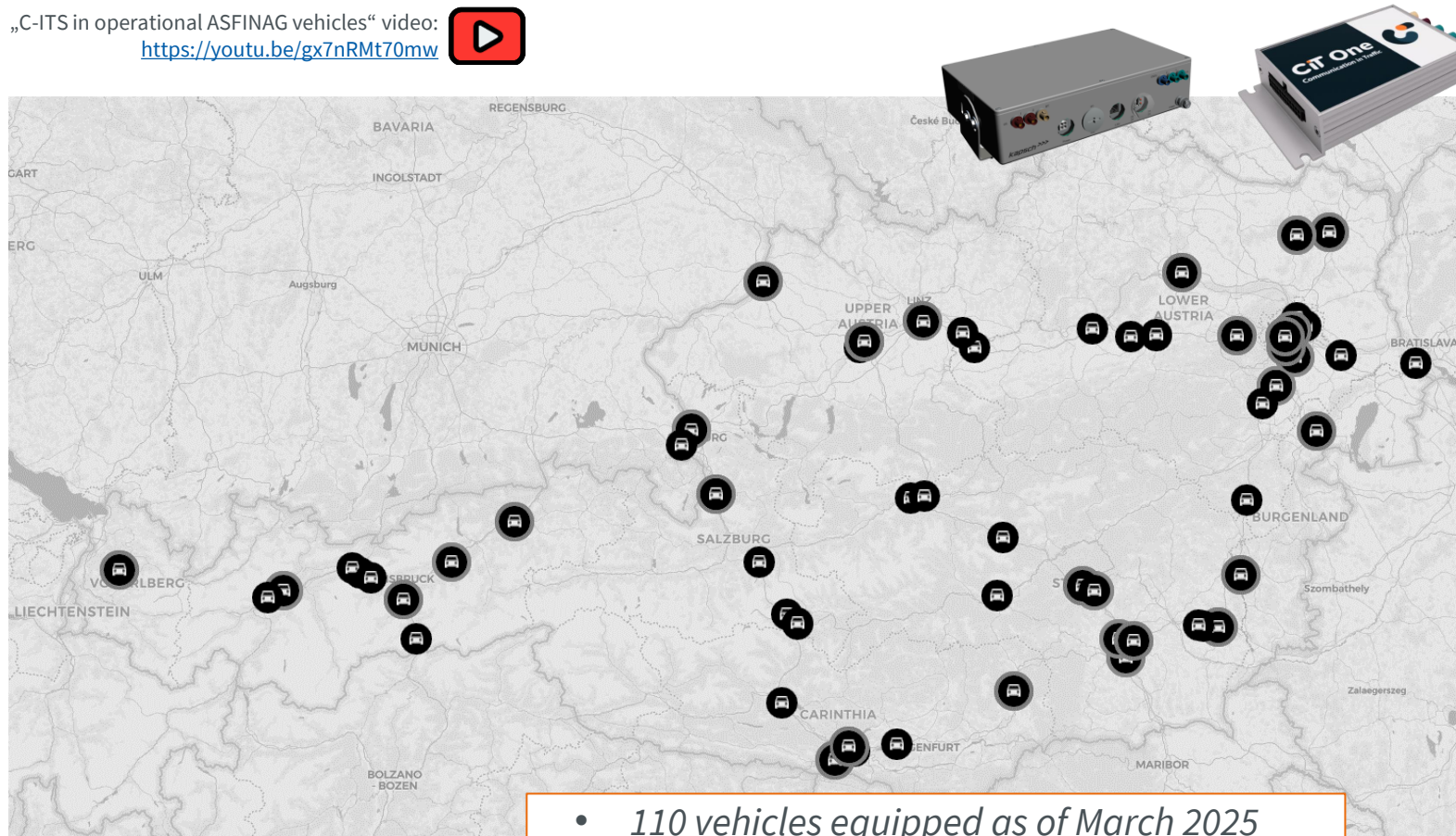
RSU COMMUNICATION RANGES



MISSION C-ITS: VEHICLE DEPLOYMENT

C-ITS equipped road operator vehicles stationed in motorway operation and maintenance facilities all over Austria

„C-ITS in operational ASFINAG vehicles“ video:  <https://youtu.be/gx7nRmt70mw>



- 110 vehicles equipped as of March 2025
- Another 80-90 units planned in 2025, especially truck mounted attenuators
- Final roll-out: 200+ units

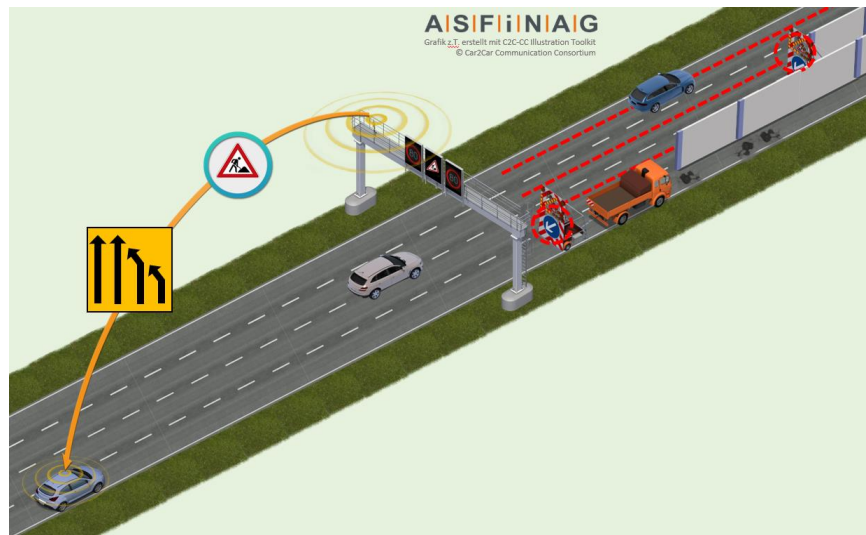
C-ITS ON-BOARD UNITS (OBU)



OPERATIONAL USE CASES ON ALL MOTORWAYS

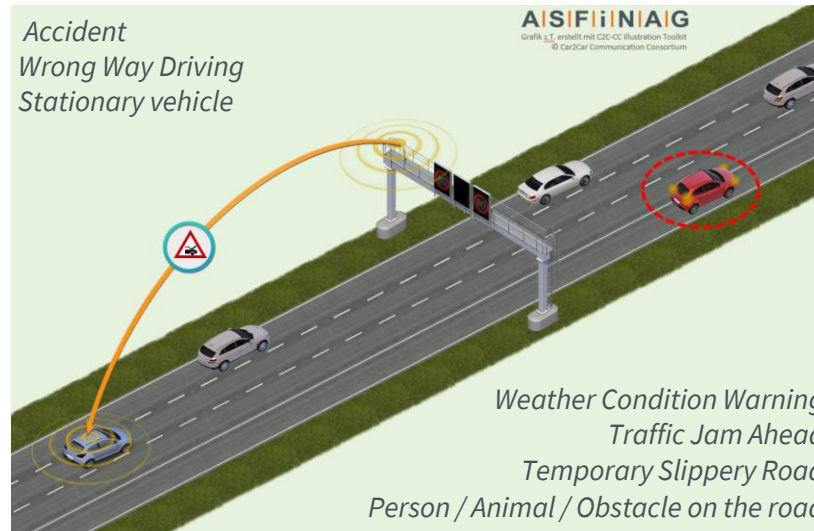
Road Works Warning

Digital warnings



Hazardous Location Notification

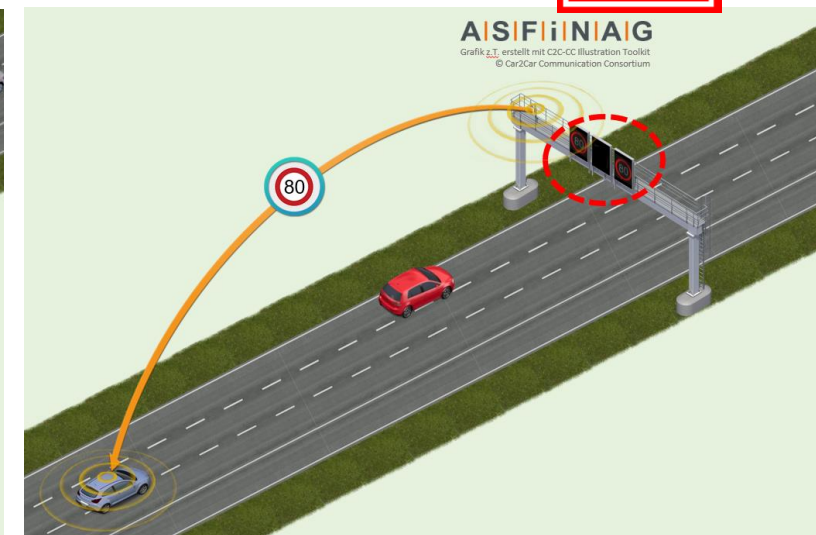
Digital hazard warnings



In-Vehicle Signage

Digitale traffic signs

coming soon



C-ITS Road Works Warning in Volkswagen ID.7

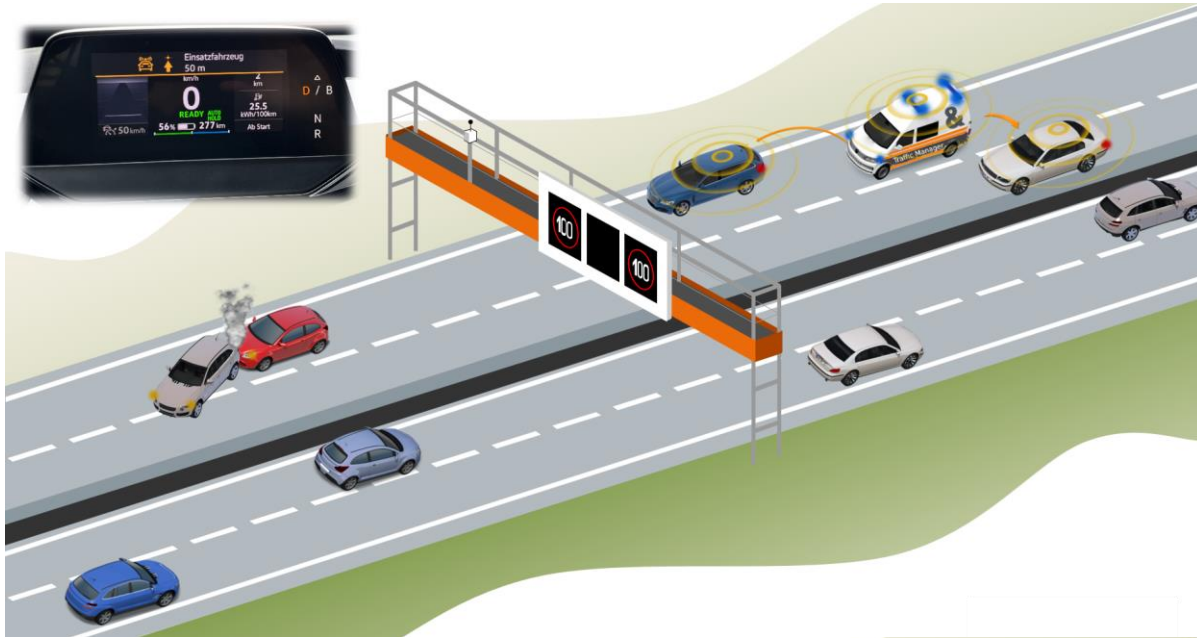


C-ITS Accident Warning in Volkswagen ID.7

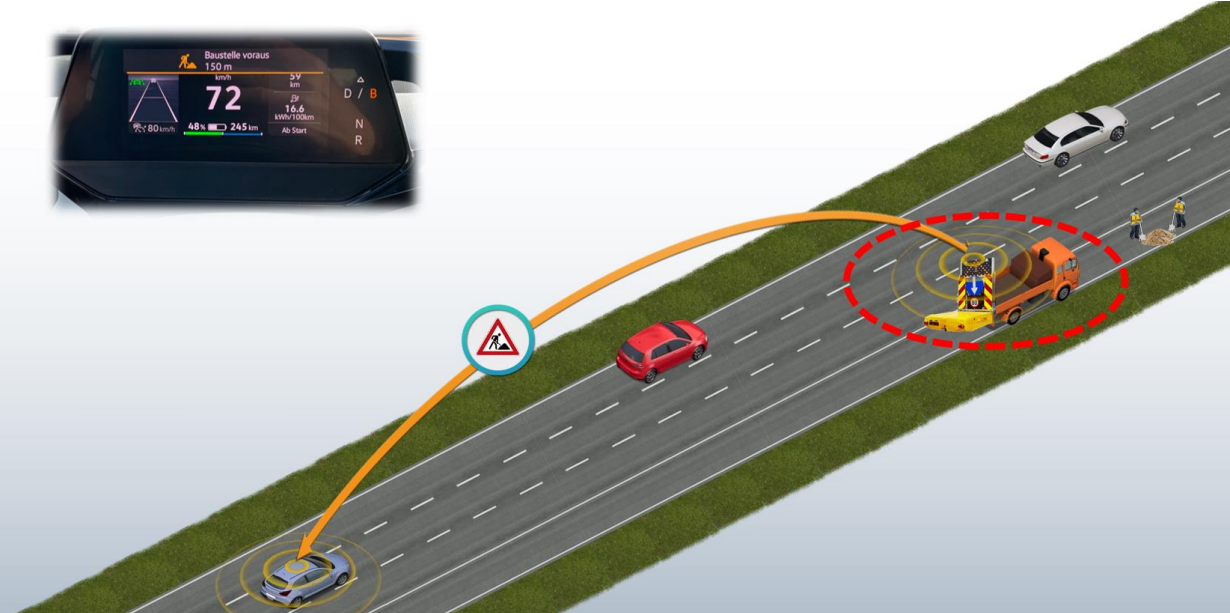
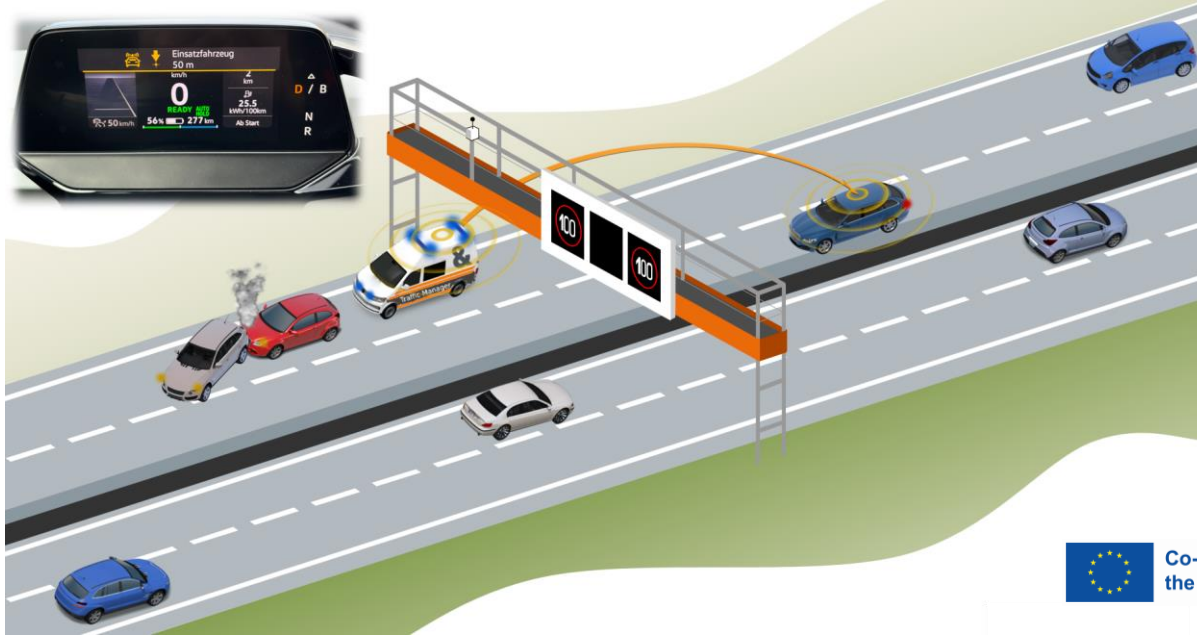


Source: „Car2X at Volkswagen – The next Steps“, Car2Car Week, 2023

ROAD OPERATOR VEHICLE USE CASES



Emergency vehicle approaching
Emergency vehicle in intervention
Roadworks warning
Slow vehicle



C-ITS USE CASES IN PRODUCTION VEHICLES



Roadworks warning
 Temporary Slippery Road
 Person / Animal / Obstacle on the road
 Emergency vehicle approaching
 Emergency vehicle in intervention

C-ITS messages visualized in a Volkswagen ID.7 and ID.3

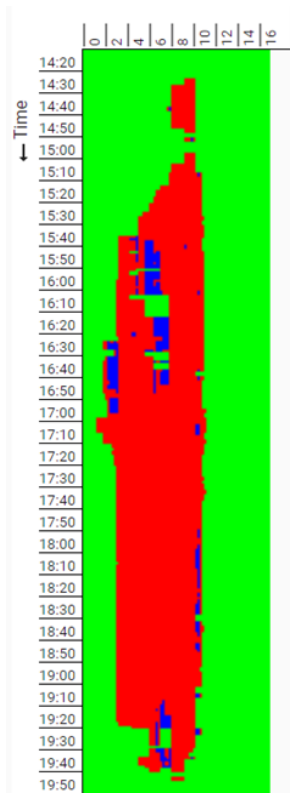
Accident
 Alert Wrong Way Driving
 Stationary vehicle
 Weather Condition Warning
 Traffic Jam Ahead

1.5 – 2.0 million
 C-ITS equipped
 and activated
 vehicles on
 European roads



PVD AND DATA EXCHANGE

Improved traffic condition prognosis based on CAM (and WLAN/Bluetooth)



Vehicle notifications as input for traffic management

(Cross-border) C-ITS data exchange via IP-based C-ITS interfaces



 Traffic control center AT



 C-ITS Broker AT



 C-ITS Broker IT

NEXT GENERATION C-ITS USE CASES (SELECTION)

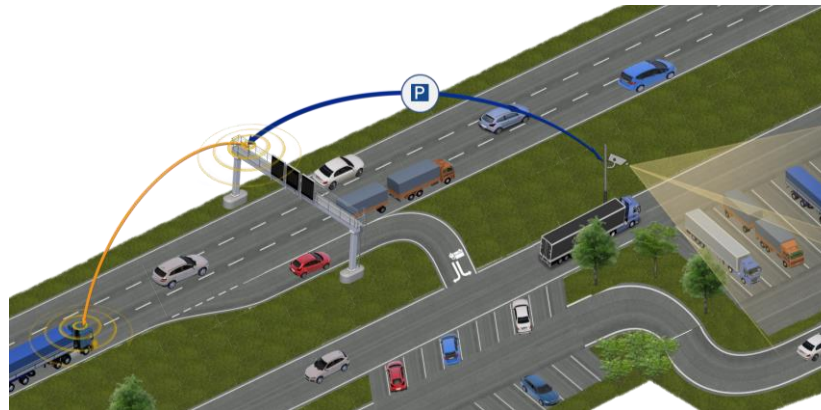
Collective Perception & Automated Vehicle Guidance

Enhancement of **environmental perception** in vehicles using roadside sensors, object recognition and CPM messages, at tunnel entrances or junctions



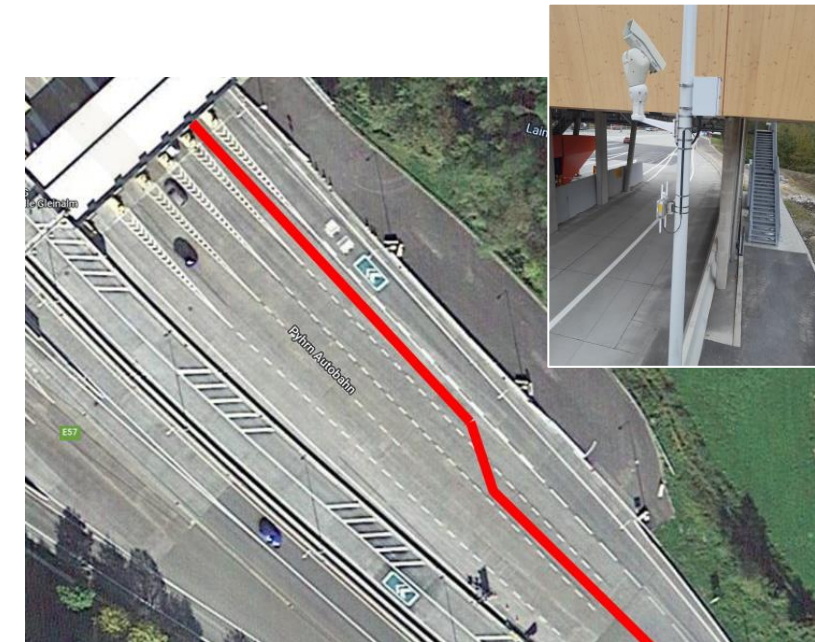
Parking Availability

Real-time information about **parking spaces** through suitable sensors at rest areas using the Parking Availability Service and the POIM-PA message



Toll Station Vehicle Guidance

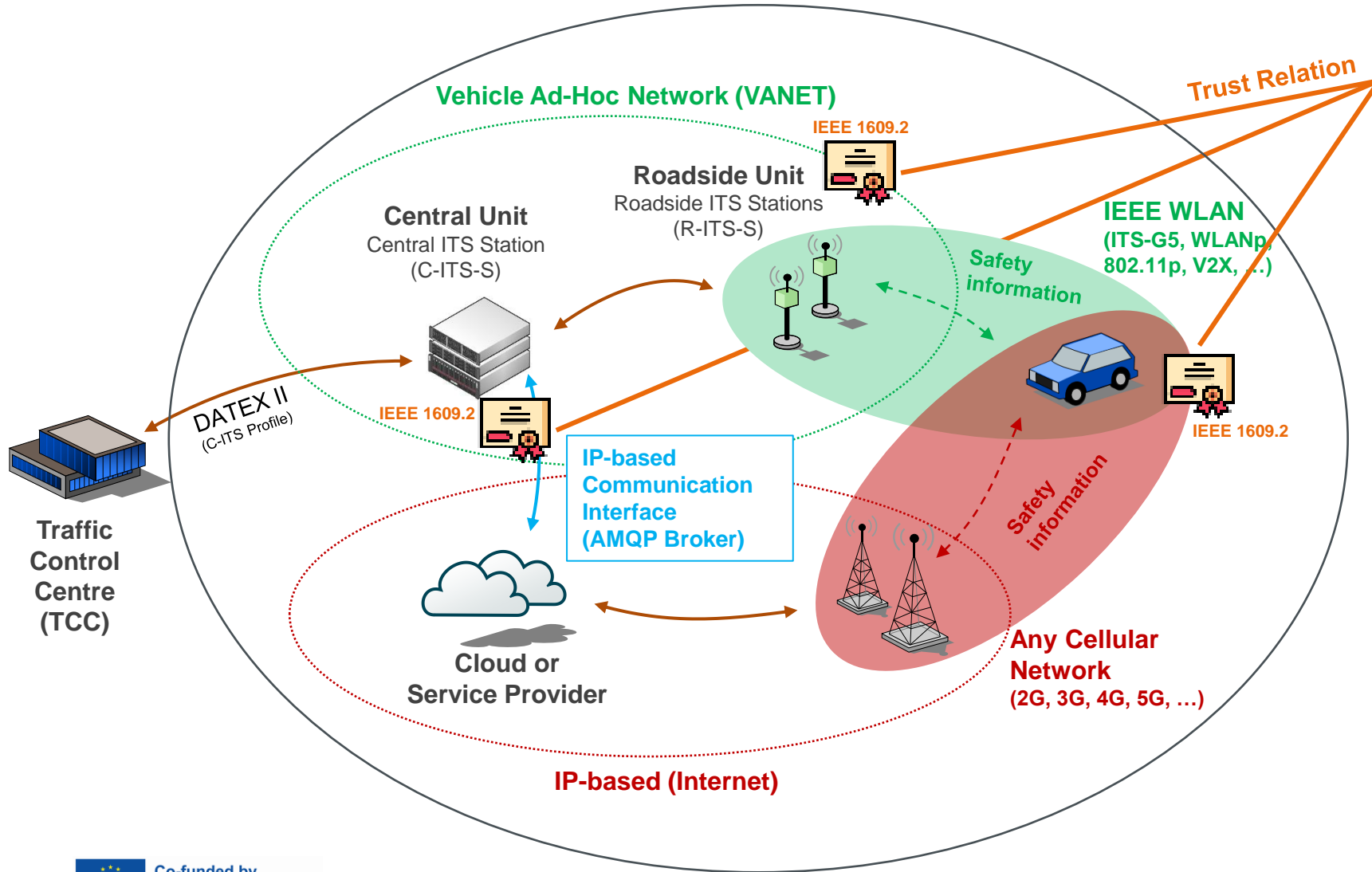
Assistance in **approaching and crossing toll stations** using In-Vehicle Information (IVIM) and Map (MAPEM)



FULLY HYBRID AND TRUSTED

EU C-ITS Security Credential Management System

C-ITS Trust Domain



EU CCMS
TLM
CPOC
EU Root CA
EA / AA
PKI

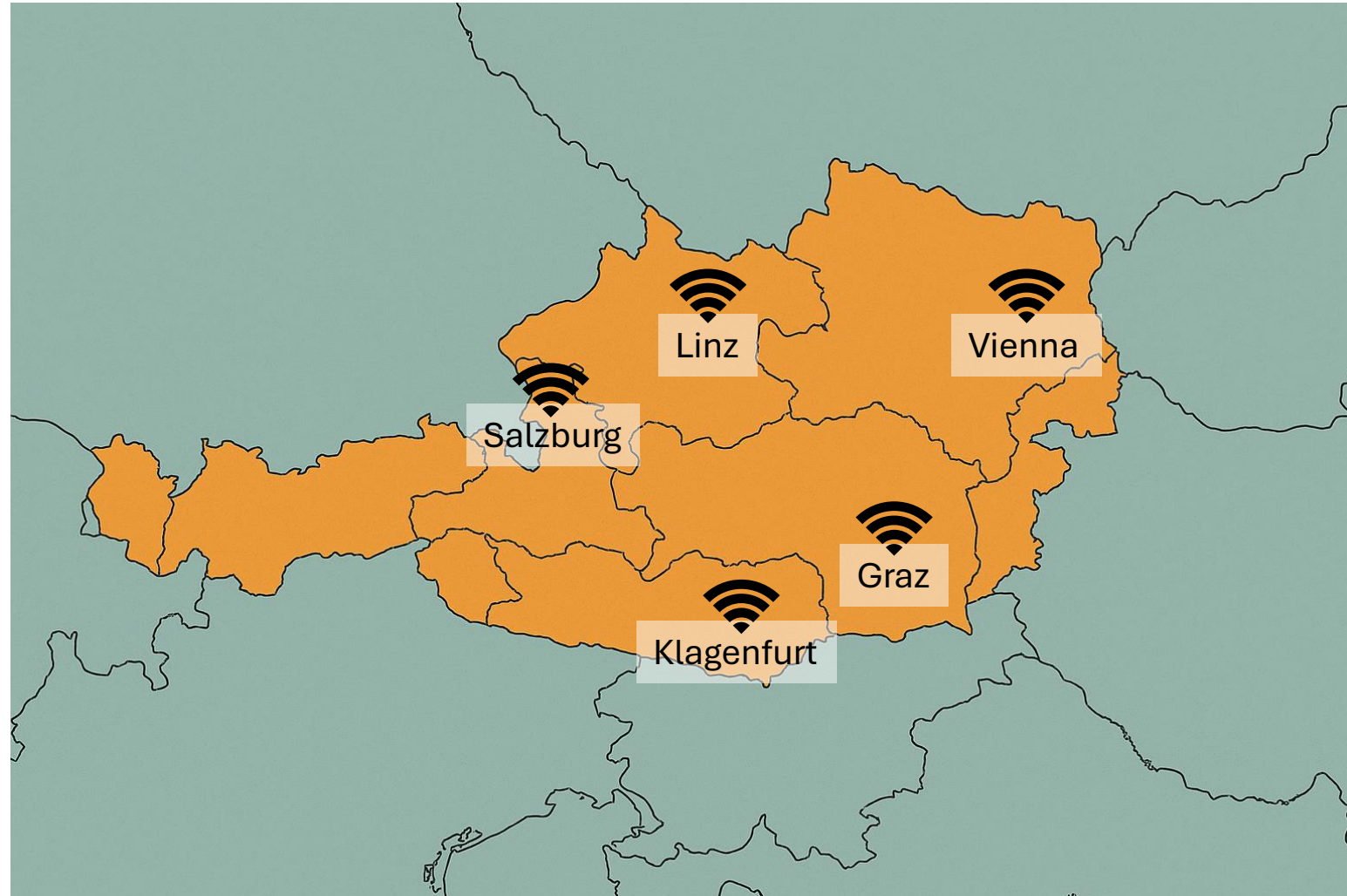
Without trust, C-ITS systems could be manipulated - e.g. through fake warnings or unauthorized participants, jeopardizing road safety

What does that mean for you as infrastructure provider?

- Certified / evaluated devices (provided by the vendor)
- Certified PKI system (buy as a service or do your own)
- ISMS in your organization
 - Self assessment (ECTL L1)
 - NIS or ISO 27001 (ECTL L2)

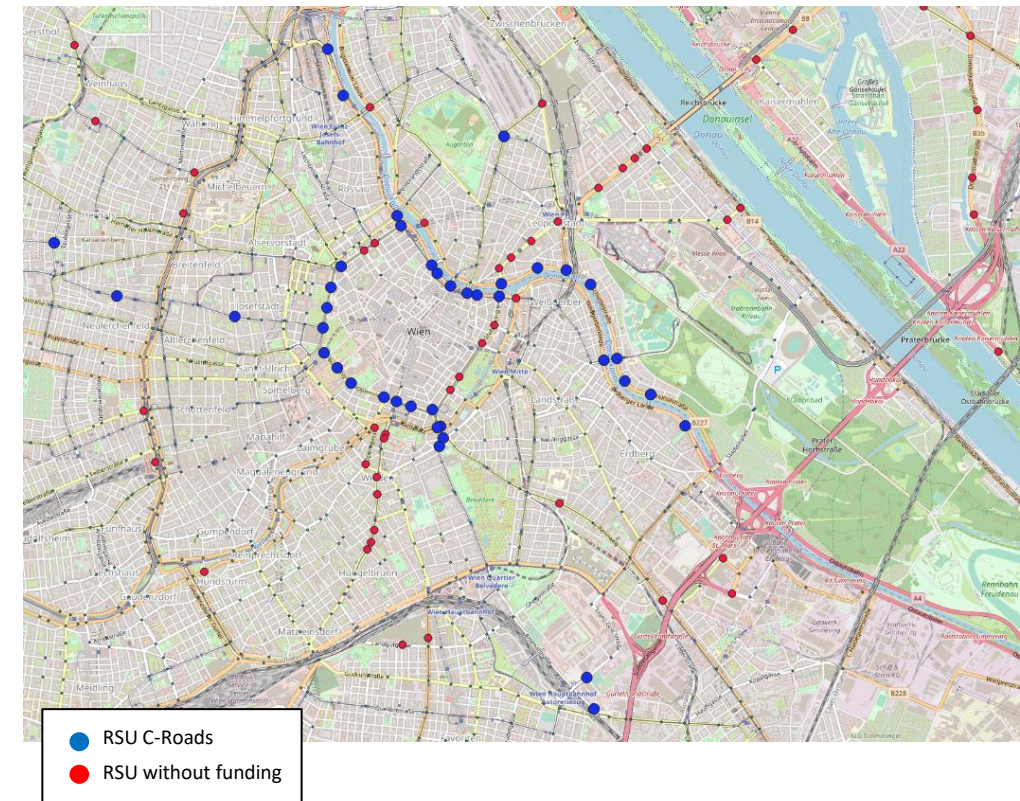
Urban C-ITS in Austria

- C C-ITS is also deployed operationally in urban areas in Austria already
 - C 1st, 2nd, 3rd, 4th and 6th largest city
- C Main “enabler” for cities:
 - C Signalized Intersection and Public Transport Prioritization (SI-TLP)
- C Replacing proprietary radio solutions in licensed frequency bands (e.g. TETRA) with harmonized and trusted communication in the dedicated 5.9 GHz ITS Band available for free
- C Seizing funding opportunities
- C Once deployed for one reason, all the other benefits of C-ITS (I2V and V2I) can be used as well



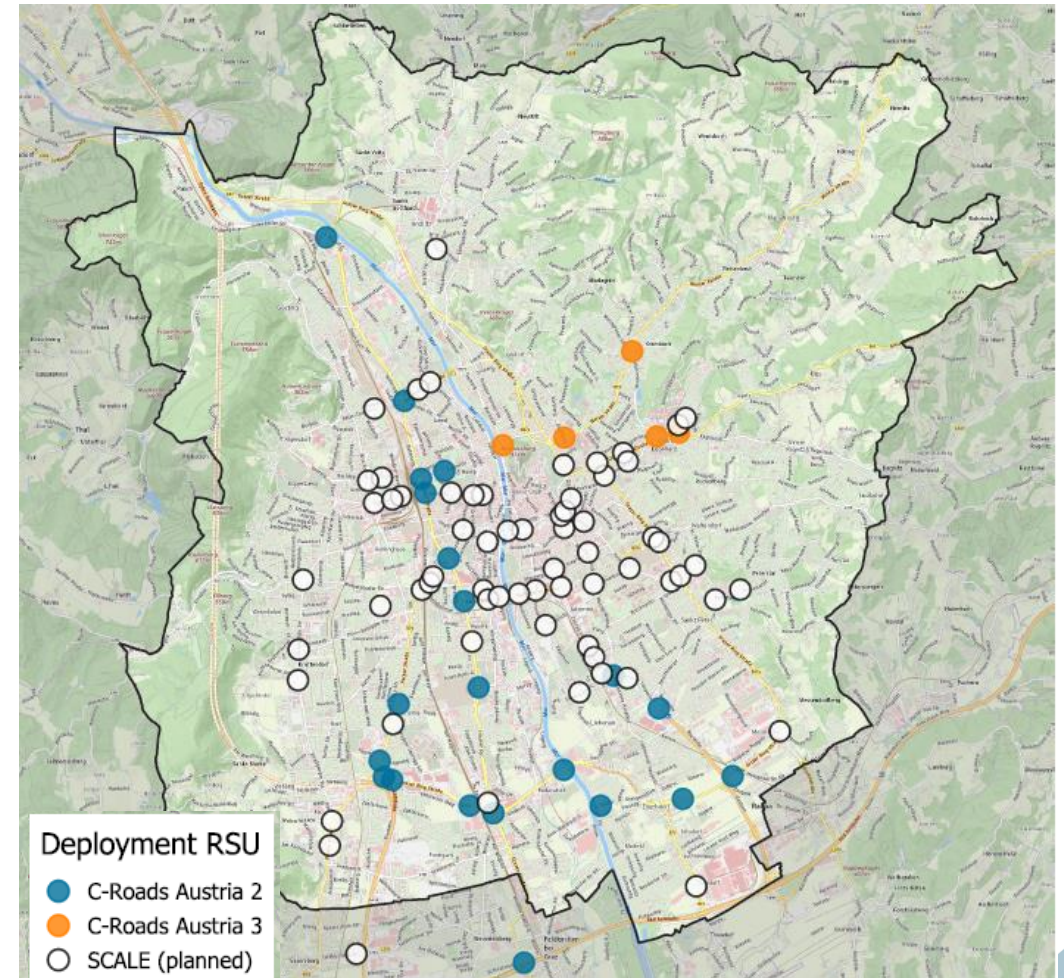
Urban C-ITS in Austria: Vienna

- ⦿ Urban road sections from motorway intersections to the city center with a total length of appr. 17 km and 70 traffic lights using signalized intersection and TLP
- ⦿ Use Cases implemented:
 - ⦿ Signalized intersection (TLP)
 - ⦿ In-Vehicle Signage
 - ⦿ Road Works Warning
 - ⦿ Hazardous Location Notification
 - ⦿ Probe Vehicle Data
- ⦿ 138 RSUs
- ⦿ 5 OBUs (trams)



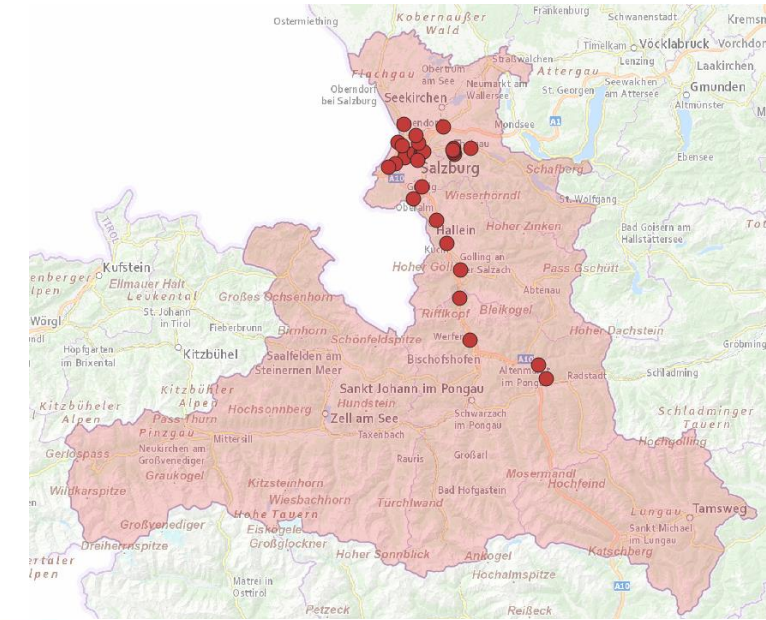
Urban C-ITS in Austria: Graz

- Fully operational traffic light priority system in 2025
- Use Cases implemented:
 - Signalized intersection (TLP)
 - In-Vehicle Signage
 - Hazardous Location Notification
 - Probe Vehicle Data
- 100 RSUs (mostly at intersections)
- 200 OBUs in buses, 100 OBUs in trams



Urban C-ITS in Austria: Salzburg

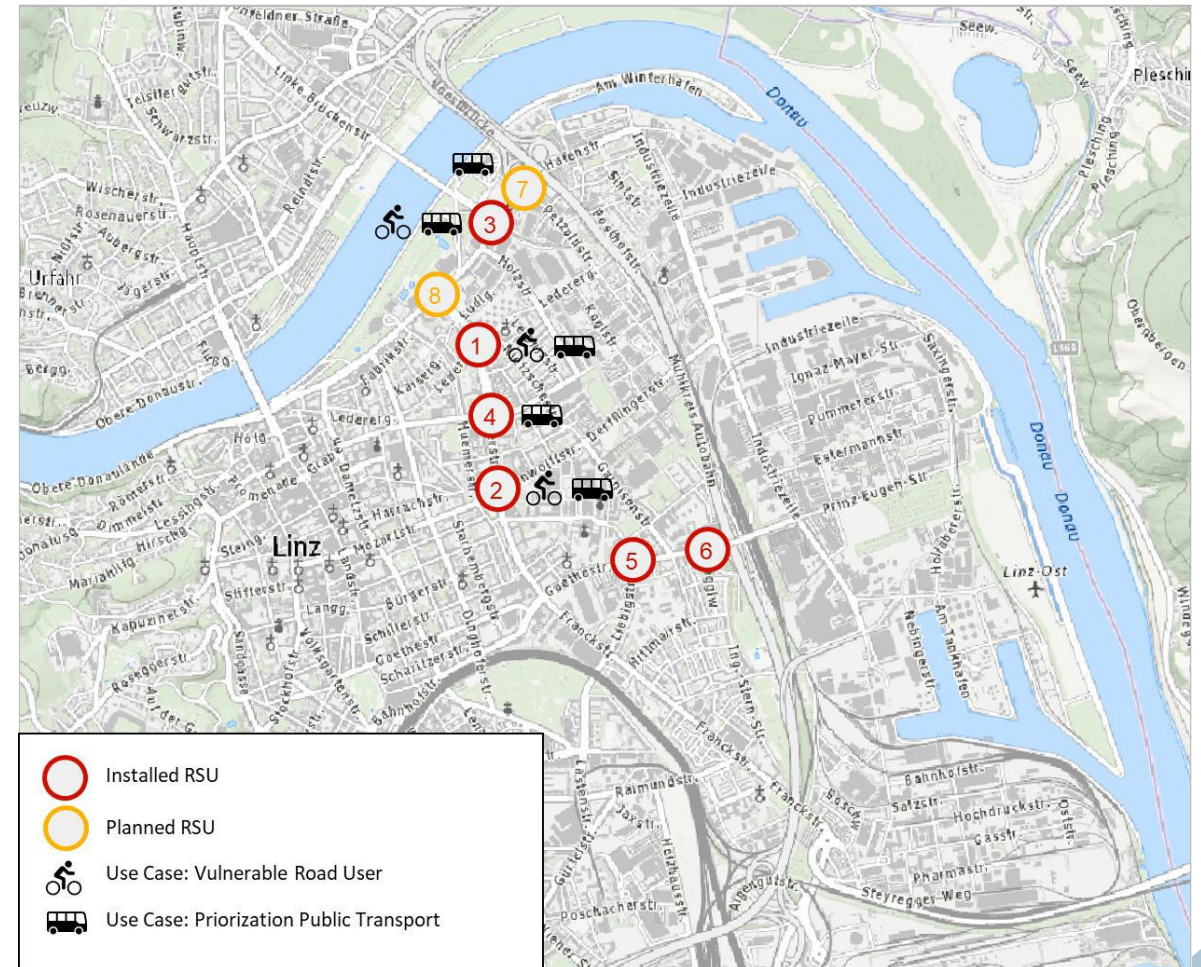
- Multi use case approach
- Use Cases implemented:
 - Signalized intersection (TLP)
 - In-Vehicle Signage
 - Road Works Warning
 - Hazardous Location Notification
 - Probe Vehicle Data
- 24 RSUs
- 10 OBUs in buses, rescue and winter maintenance vehicles



PVD	<ul style="list-style-type: none"> • Probe Vehicle Data • Event Data Collection 	
RWW	<ul style="list-style-type: none"> • Road Closure • Lane Closure • Winter Maintenance 	
SI	<ul style="list-style-type: none"> • Signal Phase and Timing Information • Traffic Light Prioritisation • Green Light Optimal Speed Advisory 	
IVS	<ul style="list-style-type: none"> • Traffic Signs (Speed Limits) • Free Text 	
HLN	<ul style="list-style-type: none"> • Emergency Vehicle Approaching • Emergency Vehicle in Intervention • Public Transport Vehicle Crossing • Public Transport Vehicle at a Stop 	

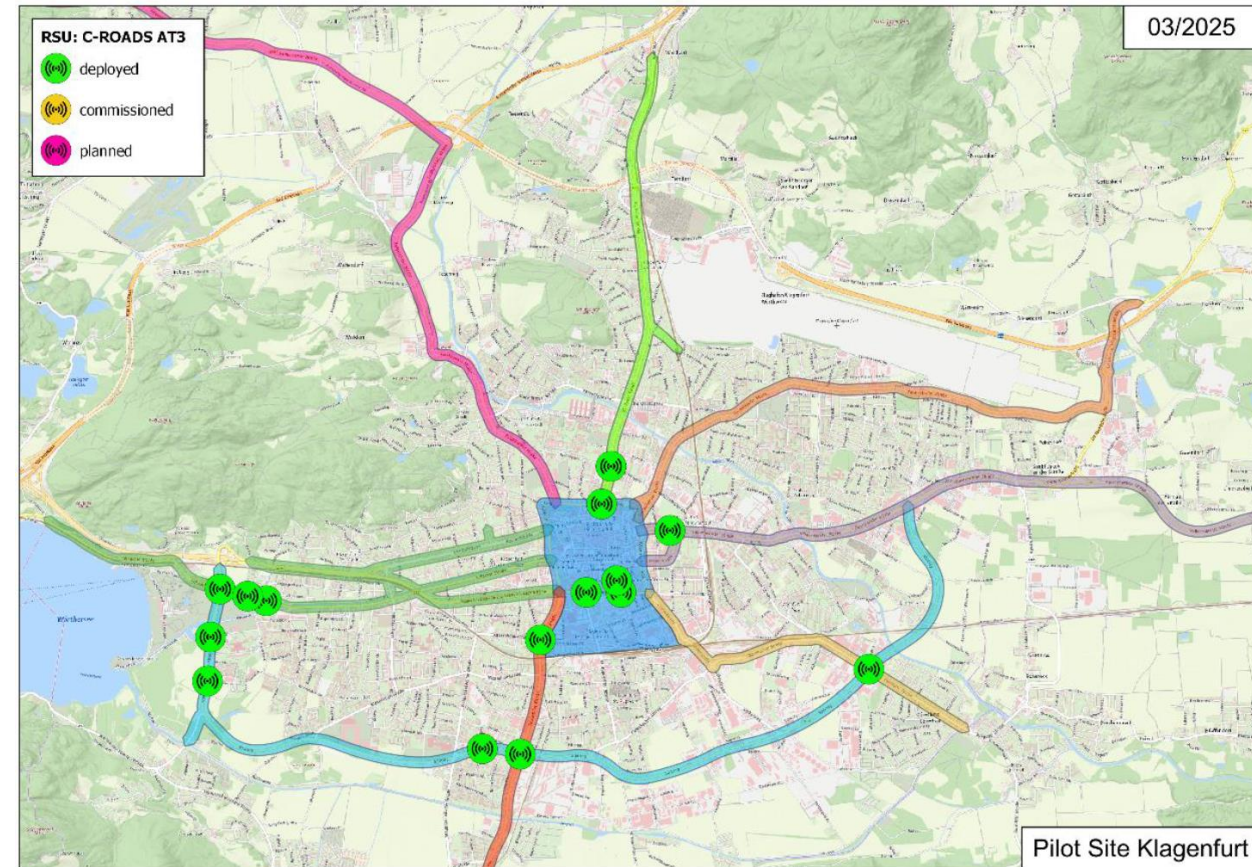
Urban C-ITS in Austria: Linz

- C Public Transport Prioritization and VRU Protection
- C Use Cases implemented:
 - C Signalized intersection(TLP)
 - C Hazardous Location Notification
 - C Probe Vehicle Data
- C 8 RSUs
- C 6 OBUs
- C 3 intersections with VRU detection



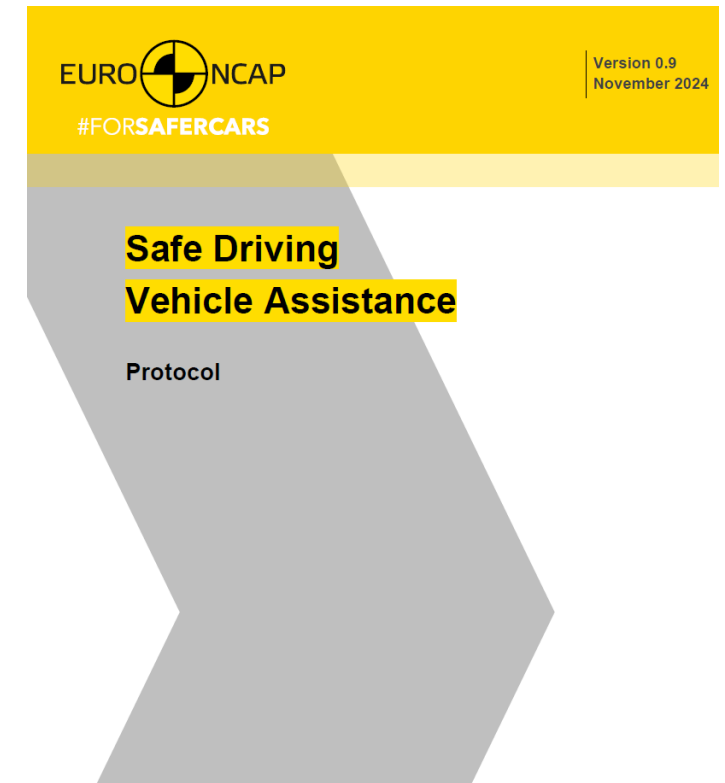
Urban C-ITS in Austria: Klagenfurt

- Fully operational traffic light priority system
- Use Cases implemented:
 - Signalized intersection
 - Hazardous Location Notification
 - Probe Vehicle Data
- 82 OBUs in buses (the whole fleet)
- 25 RSUs
- Further activities
 - Barrier control
 - VRU Intersection Monitoring
 - Test track for autonomous driving with 3 autonomous shuttles



Euro NCAP rates local hazards

- The European New Car Assessment Programme (Euro NCAP) is a voluntary safety rating system.
- Euro NCAP included „Local Hazards“ in its „Safe Driving“ Protocol for 2026
- Local Hazards are
 - Warnings of local hazards, communicated via car-to-car communication or cloud communication, and received by vehicles to inform the driver
 - known from SRTI regulation
 - matching Day-1 C-ITS Use Cases
- OEMs write a „dossier“, no formalised test necessary



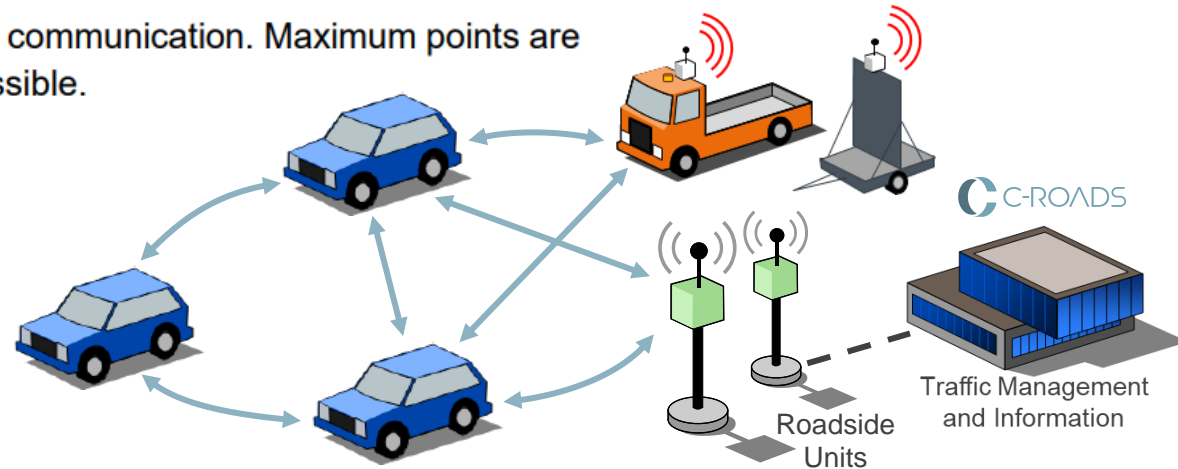
<https://www.euroncap.com/media/83737/euro-ncap-protocol-safe-driving-vehicle-assistance-v09.pdf>

Two ways of communication

Vehicles may communicate with a public cloud or via direct communication. Maximum points are achieved when both cloud and direct communication is possible.

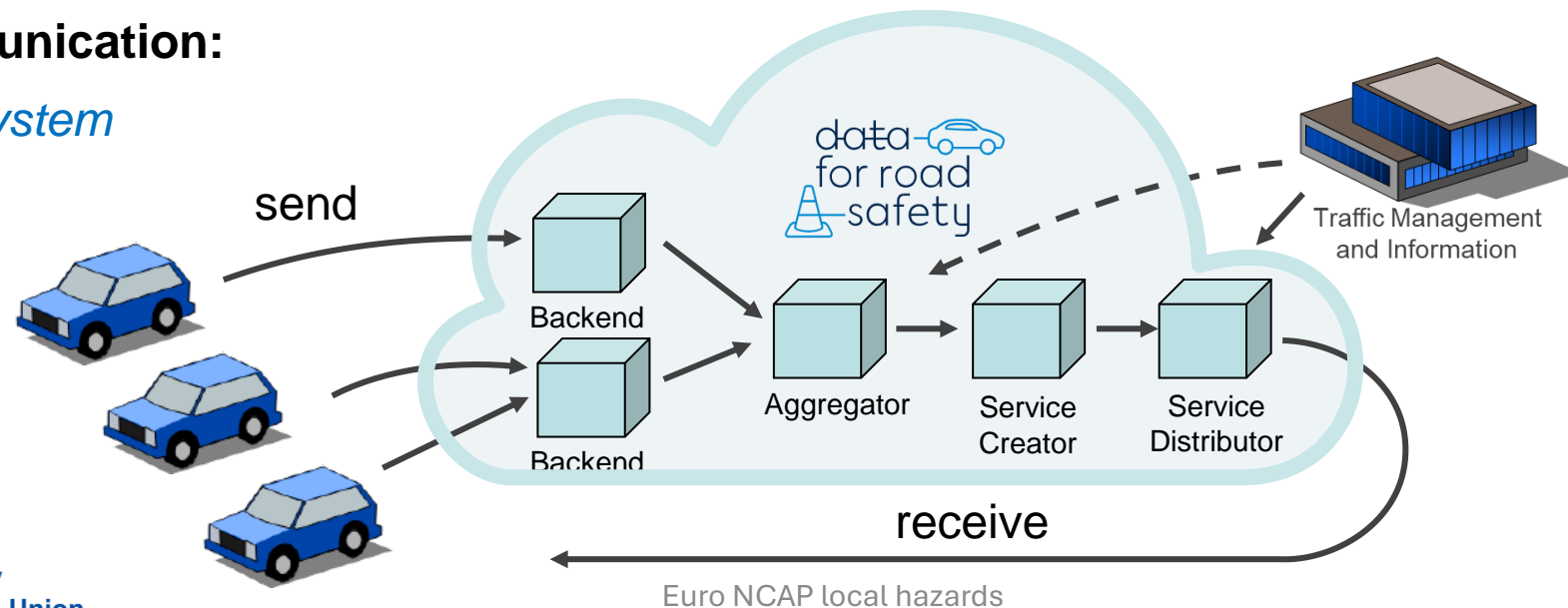
Direct communication:

Cooperative ITS ecosystem



Cloud communication:

DFRS ecosystem



Local Hazards - Overview

1.2.3 Local Hazards

Local Hazards	Direct or Cloud Communication		Direct & Cloud Communication	
	Sending	Receiving & informing	Sending	Receiving & informing
Construction zones	0.15	0.15	0.2	0.15
Items on road	0.15	0.15	0.2	0.15
Stopped vehicle*	0.15	0.15	0.2	0.15
Broken down vehicle*	0.15	0.15	0.2	0.15
Post crash*	0.15	0.15	0.2	0.15
Poor weather*	0.15	0.15	0.2	0.15
Poor road*	0.15	0.15	0.2	0.15
Wrong way driver*	0.15	0.15	0.2	0.15
Amber + Blue lights	N/A	0.15	N/A	0.15
Traffic jam	N/A	0.15	N/A	0.15
TOTAL (capped)	Max 2.5		Max 3.0	

Direct Communication: Short-range communication
Cloud Communication: Data for Road Safety (DFRS)

Sending: from the vehicle (V2I and V2V)
Receiving: to the vehicle (I2V and V2V)

Vehicles able to send and receive local hazard information are eligible to score the available points shown in the table above. Points can be scored individually. Local hazards service shall be available in all Euro NCAP Application Area (as defined in TB002).

Vehicles may communicate with a public cloud or via direct communication. Maximum points are achieved when both cloud and direct communication is possible.

“Receiving and informing” is understood as retrieving local hazard information into the vehicle and informing the driver about them in due time before reaching the event location.

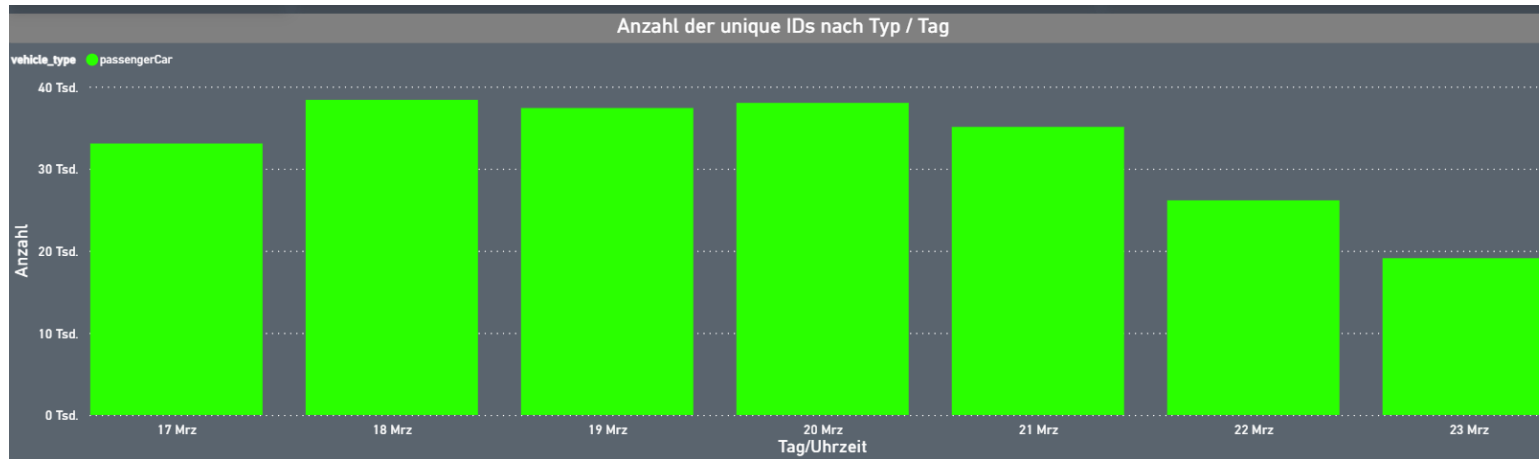
“Sending” understood as sharing local hazard information gathered by the vehicle within the DFRS cloud ecosystem or direct network.

*When sending information, only information about the condition of the ego vehicle is requested

NCAP Outlook

- Local Hazards in Euro NCAP 2026 are a first step
- Direct Communication has a high potential in the future
 - E.g. use cases where vehicles use information from C-ITS messages to automatically slow down or brake
 - E.g. use cases where on-board radar sensors use C-ITS messages of other vehicles to extend their electronic horizon
 - Both requires trust and will most likely need direct communication

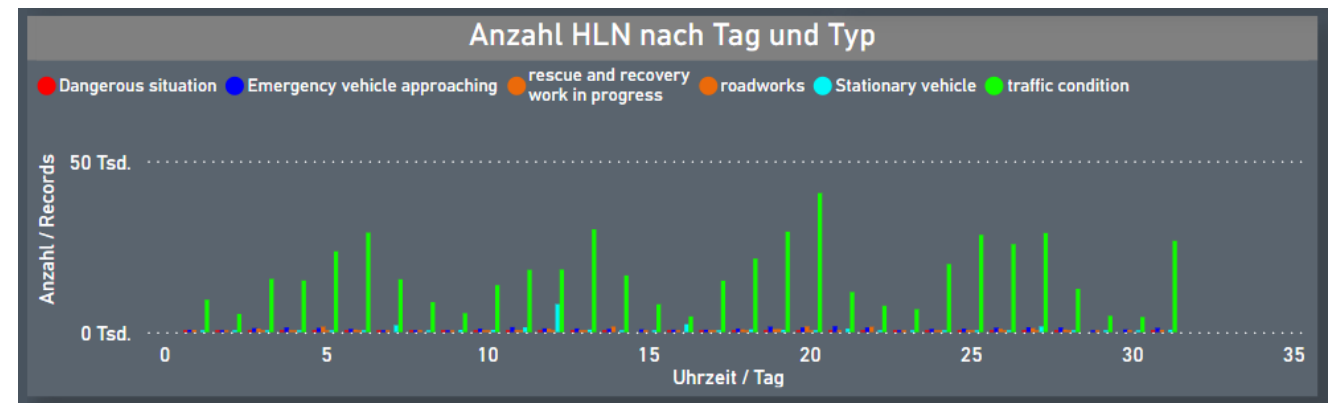
PVD – THE TRUE VALUE OF C-ITS FOR INFRASTRUCTURE



30-40k unique* stationIds (vehicles) per weekday

20-30k unique* stationIds (vehicles) on weekends

*stationIds change for pseudonymization according to the C2C-CC BSP



Between 20 and 50 emergency brakings per day on average

Between 10 and 5.000 stationary vehicles per day on average

Between 5.000 and 40.000 traffic conditions per day on average

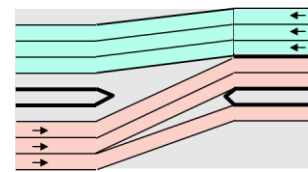
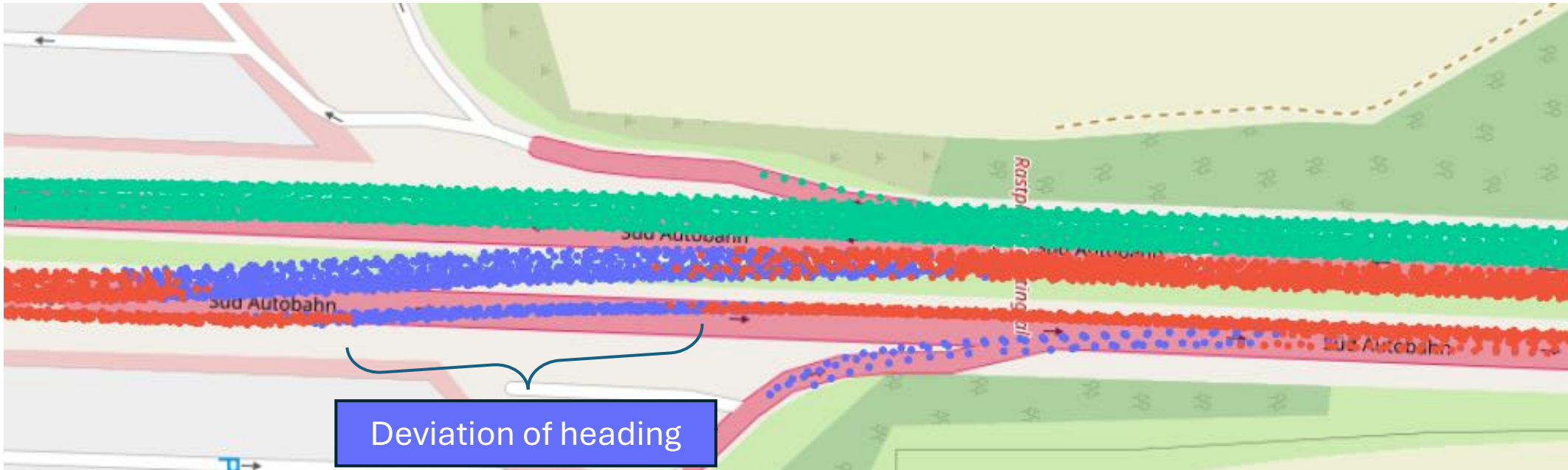
(local slow down, sudden speed drop)

PVD - CAM POINTS AND TRAJECTORIES



PVD - CAM HEADING INDICATING LANE CHANGES

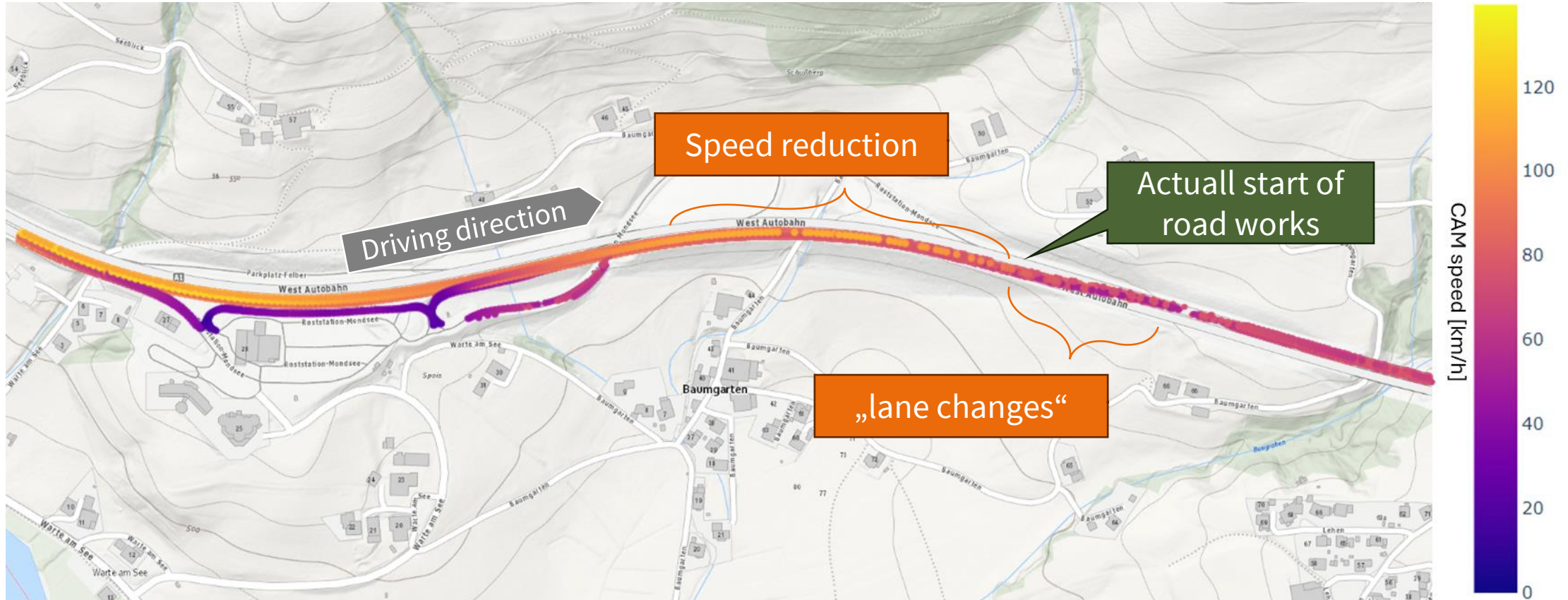
📍 Start of the construction zone with redirection on the other carriageway



- Heading west (←)
- Heading east (→)
- Heading east with deviation

PVD - CONSTRUCTION ZONE: SPEED AND LANE CHANGES

- 📍 CAMs help to validate the start time of a construction zone and its location, or to make it more precise



PVD - CAM TRACE INDICATES WRONG-WAY DRIVING

- 📍 CAM path history on an off-ramp indicates a wrong-way driver
- 📍 Location and heading are also good indicators, but less strong



PVD - CAM CONTENT INDICATING WEATHER CONDITIONS

- 📍 Fog lights indicate low visibility
- 📍 Low beam light at daytime might indicate restricted visibility, e.g. rain (unless lights are commonly used / recommended at the location)
- 📍 Upcoming in CAM Release 2: windshield wiper status

```
BasicVehicleContainerLowFrequency ::= SEQUENCE {  
    vehicleRole VehicleRole,  
    exteriorLights ExteriorLights,  
    pathHistory PathHistory  
}
```

```
ExteriorLights ::= BIT STRING {  
    lowBeamHeadlightsOn      (0),  
    highBeamHeadlightsOn    (1),  
    leftTurnSignalOn        (2),  
    rightTurnSignalOn       (3),  
    daytimeRunningLightsOn  (4),  
    reverseLightOn          (5),  
    fogLightOn              (6),  
    parkingLightsOn         (7)  
} (SIZE(8))
```

Fog light

Low beam light

PVD - INCIDENT DETECTION

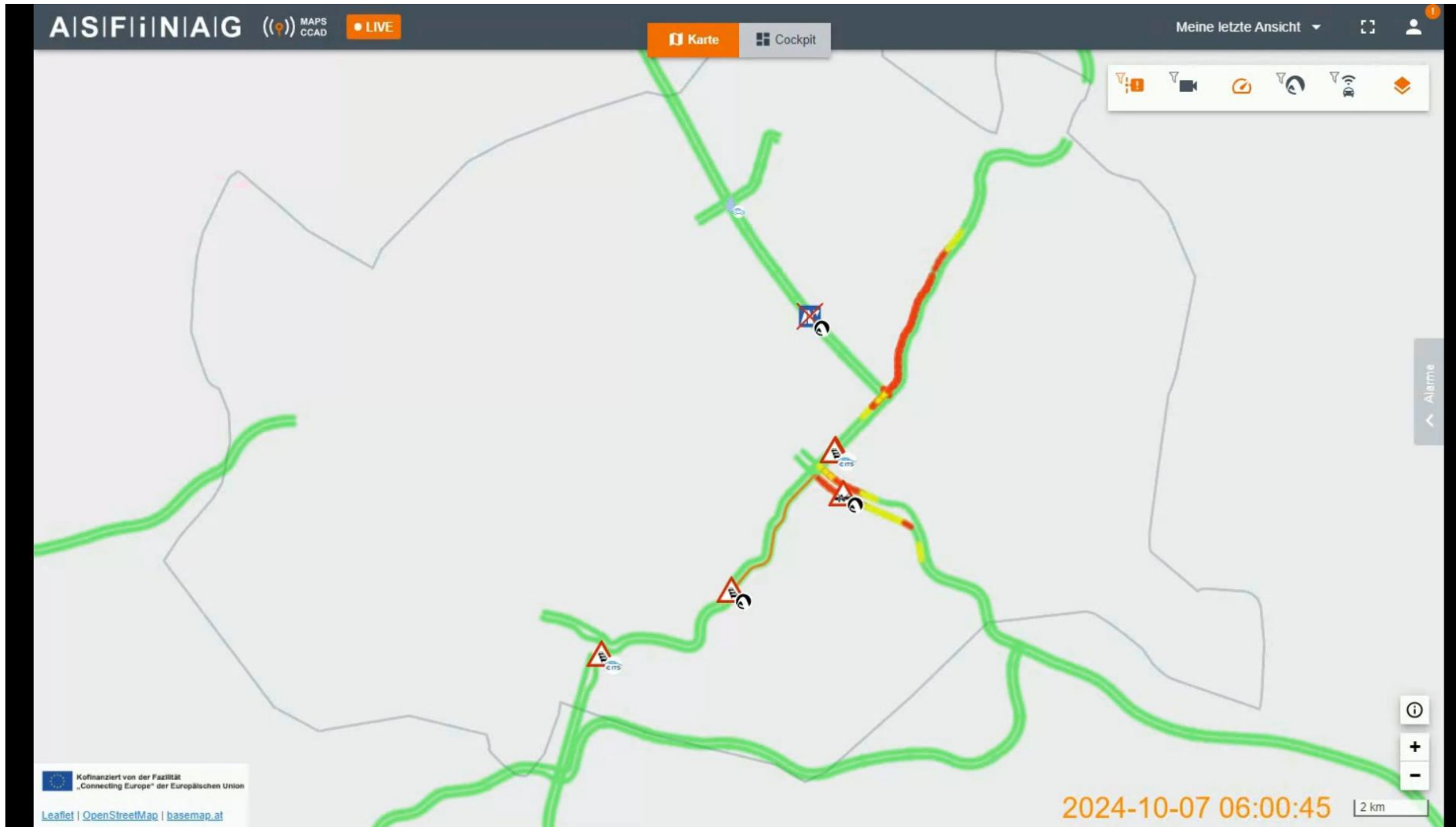
In November 2024, ASFINAG C-ITS roadside units detected the **first vehicle accident message with the highest severity level** (information quality 3 - high severity crash, which means that safety systems like the airbags have deployed).

The accident was reported 2 minutes and 32 seconds earlier compared to the (quite fast) conventional traffic management system. This example shows that C-ITS is already making a significant contribution to incident detection with C-ITS. Due to clear triggering conditions the established Trust Domain in the C-ITS application, this is the first data source that is trusted directly without the need for human verification.

Moments before the crash, the C-ITS-equipped vehicle sent out emergency braking warnings, alerting nearby vehicles to the danger. The system's capabilities, however, extended beyond this initial alert. As the resulting traffic congestion built up, other C-ITS-enabled vehicles caught in the jam began transmitting congestion messages, thereby enhancing situational awareness on the highway. Later on, the accident was also confirmed through additional sources, such as WAZE.



PVD – COMING TOGETHER IN TRAFFIC MANAGEMENT



**ANY QUESTIONS?
WE ARE THERE FOR YOU!**

Peter Meckel

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