



Connected vehicles on European roads: benefits for safety and traffic management

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Workshop Klimamobility 2017

April, 20th 2017

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- V2X evolution in Europe: regulatory basis.
- C-ITS platform initiative ; *Day 1 & Day 1.5* applications.
- Vehicles “point of view” and cooperative scenarios.
- C-ITS Corridor Implementation pilot: Rotterdam-Frankfurt-Vienna.
- Widening the C-ITS corridor: C-ROADS EU Member states initiative.

EC Mandate M/453 2009 regulatory basis of C-ITS



Mandate to develop a minimum set of standards for the deployment of cooperative “Intelligent Transport Systems” (ITS) in Europe:

- ❑ “ITS can create clear benefits in terms of transport efficiency, sustainability, safety and security, whilst contributing to the EU Internal Market and competitiveness objectives”.
- ❑ “(...) to ensure **interoperability** among the different systems at least throughout Europe.
- ❑ “Co-operative Intelligent Transport Systems (C-ITS systems) are based on vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I, I2V) and infrastructure-to-infrastructure (I2I) communications for the exchange of information.”
- ❑ This mandate is the basis of **EMEA standardization activity at ETSI**

EC Directive 2010 (2010/40/EU), add. No 886/2013
Minimum set of road safety-related traffic information
services

[free of charge to users on the European Roads]



- ❑ Article 3 of 886/2013 lists road safety-related events or conditions (..) to ensure interoperability among the different systems at least throughout Europe.

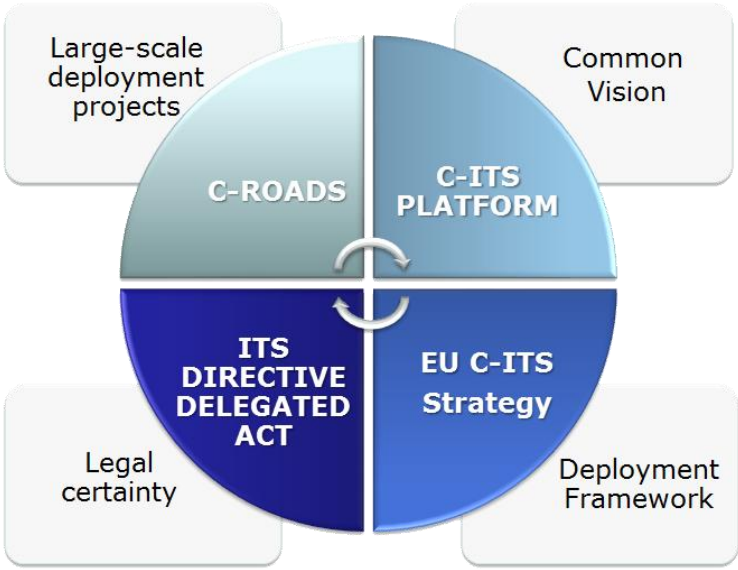
- ❑ It enables I2V application of **Hazardous Location Warning**
 - temporary slippery road;
 - animal, people, obstacles, debris on the road;
 - unprotected accident area;
 - short-term road works;
 - reduced visibility;
 - wrong-way driver;
 - unmanaged blockage of a road;
 - exceptional weather conditions.

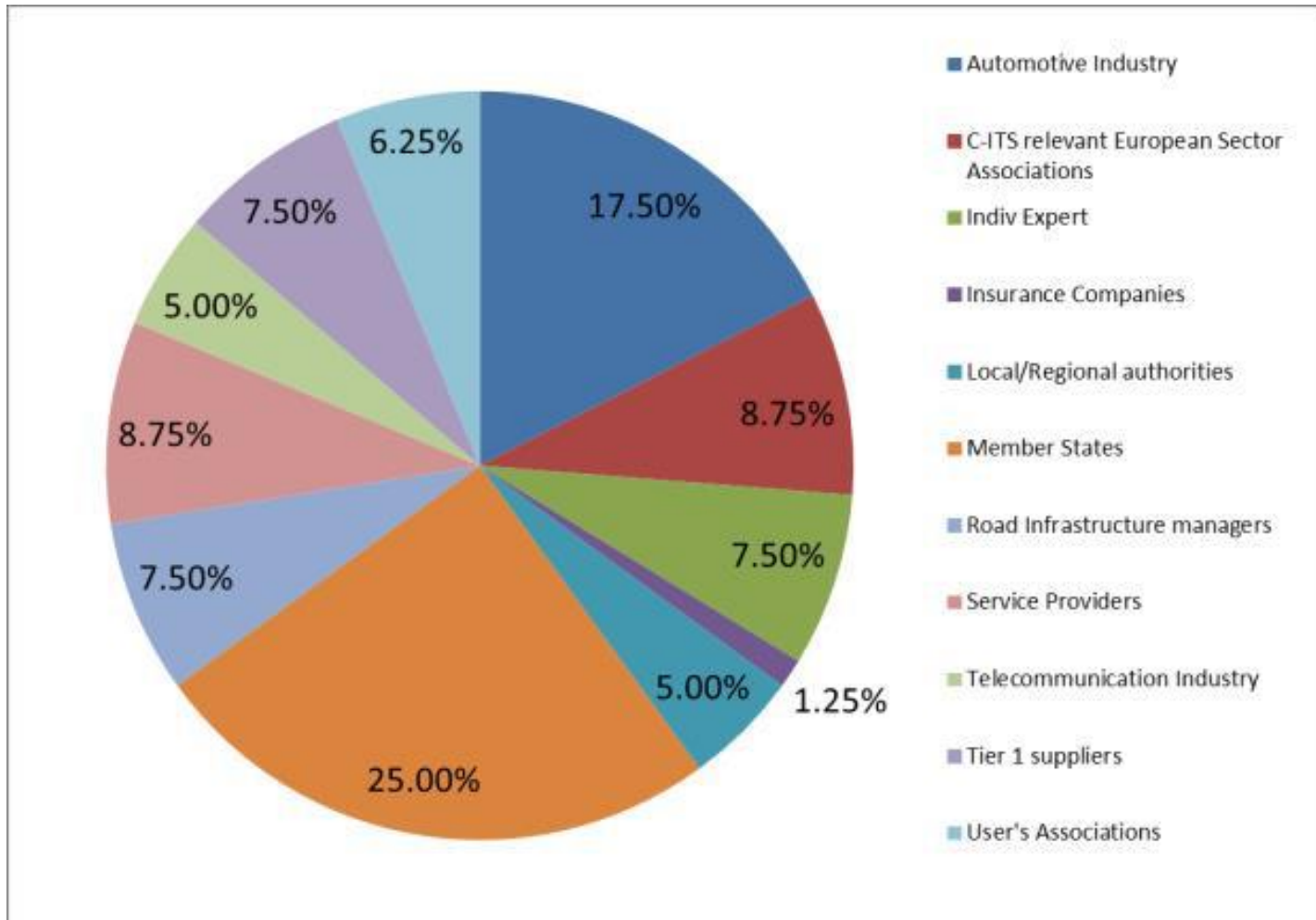


Cooperative Intelligent Transport Systems in Europe



- ❑ **C-ITS Platform:** initiative for the Deployment of Cooperative Intelligent Transport Systems ([link](#)).
- ❑ **CREATED** by the European Commission (DG MOVE) in Nov. 2014 as a cooperative framework including national authorities, C-ITS stakeholders and the EU Commission.
- ❑ **OBJECTIVE** to achieve a **common vision** across all actors involved in the value chain.
- ❑ **OUTCOME** «C-ITS Platform final report», January 2016 ([link](#))





Why “*Day 1*”?

- expected societal benefits
- maturity of technology

Hazardous location notifications:

- Slow or stationary vehicle(s) & Traffic ahead warning
- Road works warning
- Weather conditions
- Emergency brake light
- Emergency vehicle approaching
- Other hazardous notifications

Signage applications:

- In-vehicle signage
- In-vehicle speed limits
- Signal violation / Intersection Safety
- Traffic signal priority request by designated vehicles
- Green Light Optimal Speed Advisory (GLOSA)
- Probe vehicle data
- Shockwave Damping (falls under ETSI Category “local hazard warning”)

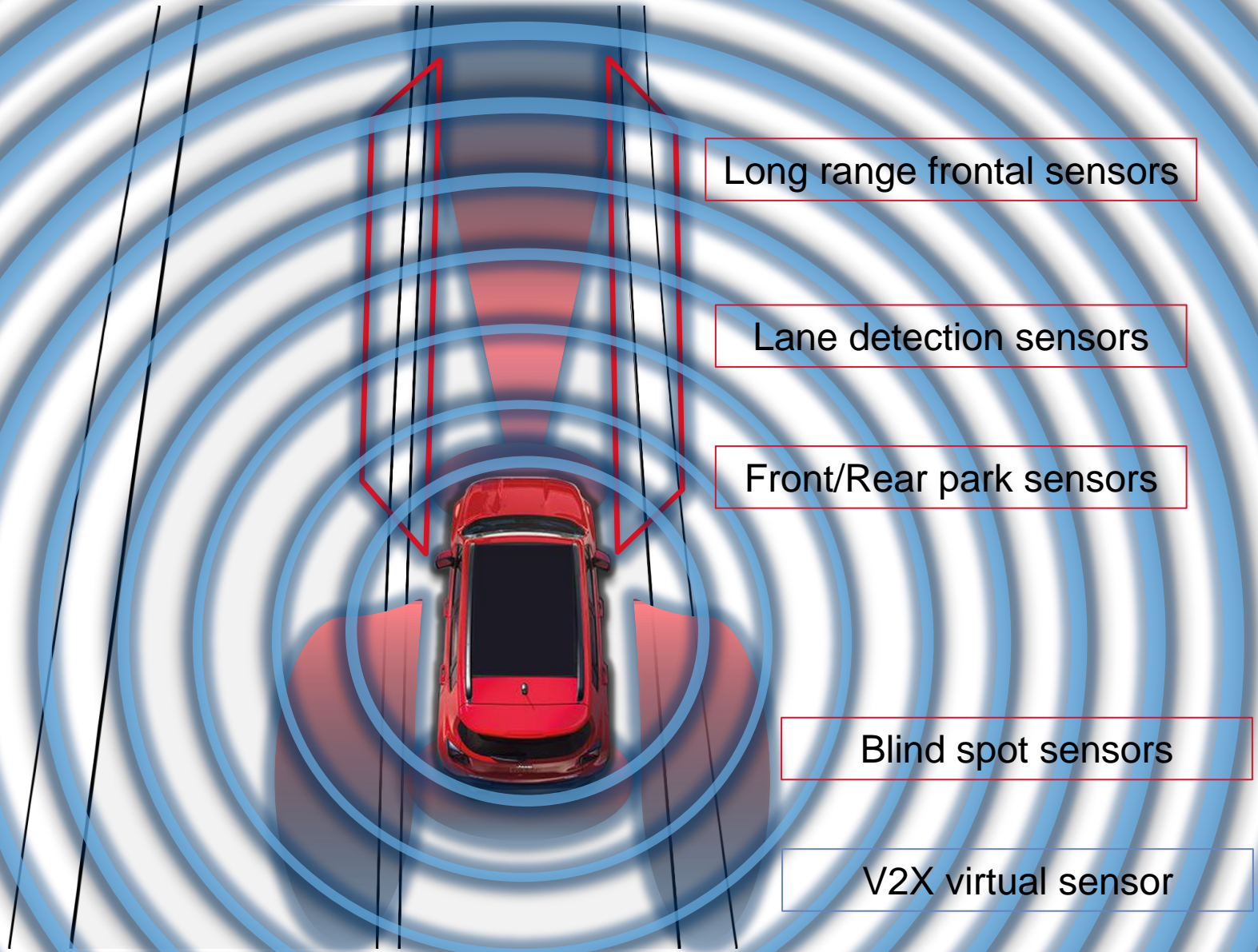
Why “*Day 1.5*”?

- mature and desired by the market
- not completely ready in terms of specifications and standards

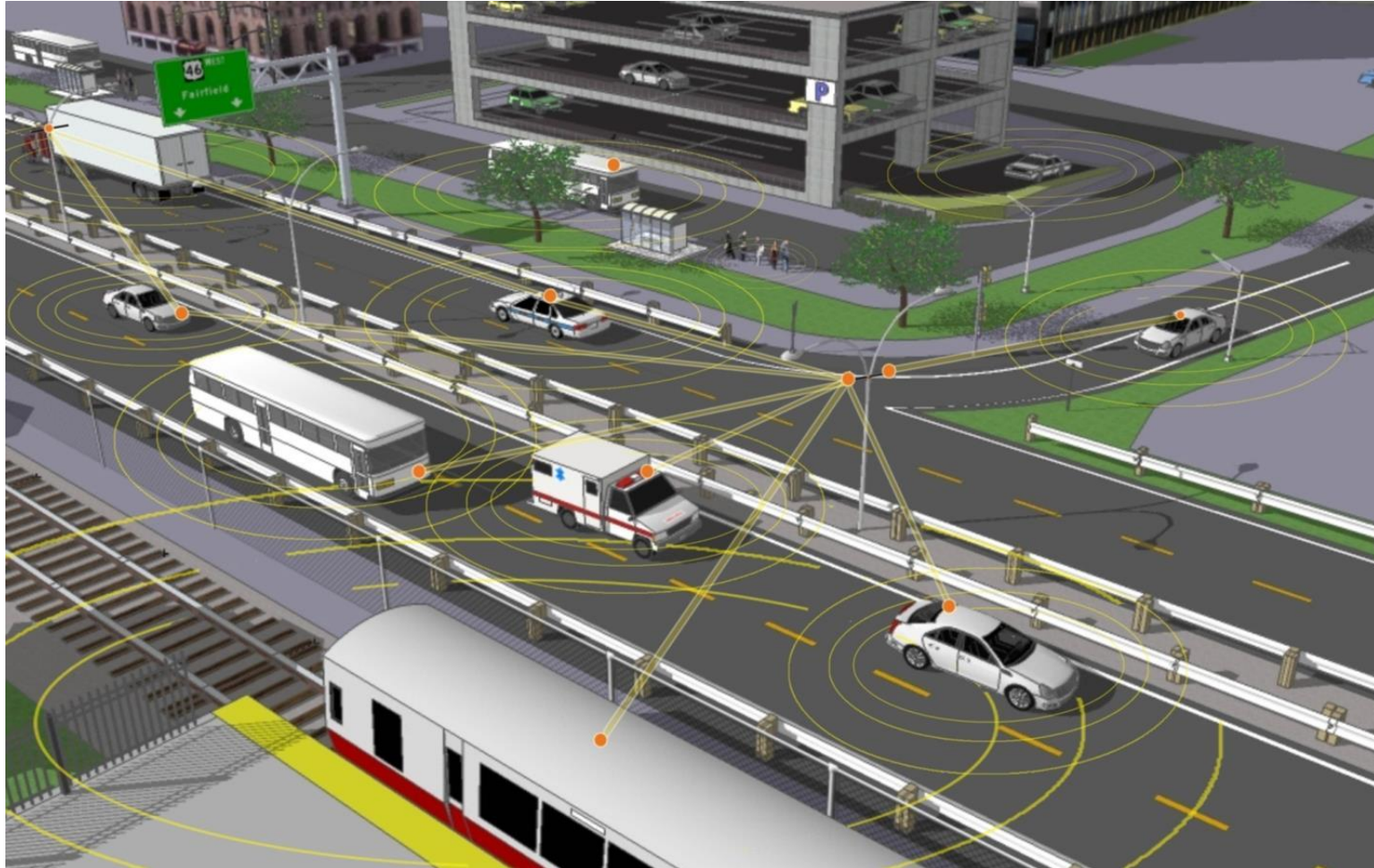
- Information on fueling & charging stations for alternative fuel vehicles
- Vulnerable Road User protection
- On street parking management & information
- Off street parking information
- Park & Ride information
- Connected & Cooperative navigation into and out of the city
(1st and last mile, parking, route advice, coordinated traffic lights)
- Traffic information & Smart routing

NOTE: mainly info-mobility services, except from VRU protection

Vehicle Sensors Overview



Cooperative Scenarios: V2V visual representation



Source: "Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application", NHTSA DOT HS 812 014, August 2014

<https://www.safercar.gov/v2v/index.html>

In-Vehicle Speed Limits adaptation from Traffic Control Center

- Variable Message Signs displays speed limits & warnings, managed by Traffic Control Center.
- Vehicle-To-Infrastructure [V2I] system provides the same information directly inside the car, and makes it available to the vehicle system.



Img source: ASFINAG, <http://services.asfinag.at/>



NOTE: possible visualization of IVI, this image does not represent a real FCA dashboard solution

Use Case: Emergency Electronic Brake Light

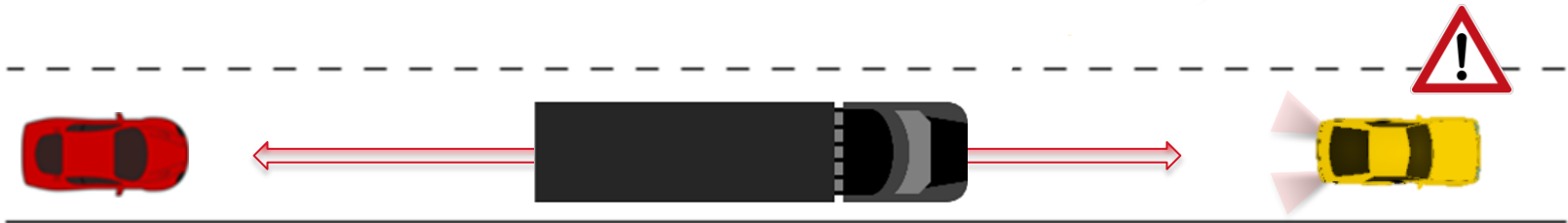
Hazard event generated by another vehicle

- Approaching a vehicle stopped or hard braking in roadway not visible due to obstructions.
- Vehicle-To-Vehicle [V2V] system provides instantly a notification directly inside approaching cars and makes it available to the vehicle system.



Source: Ford, 2014

step #1 V2V generated event



step #2 V2V received event

Deployment of the C-ITS platform concept

Phases:

1. Pre-development and proof-of-concept

Day 1 Use Cases along motorway/city corridor
Rotterdam-Vienna

2. Nationwide Deployment

Road Works Warning and
Probe Vehicle Data
(NL – DE – AT)



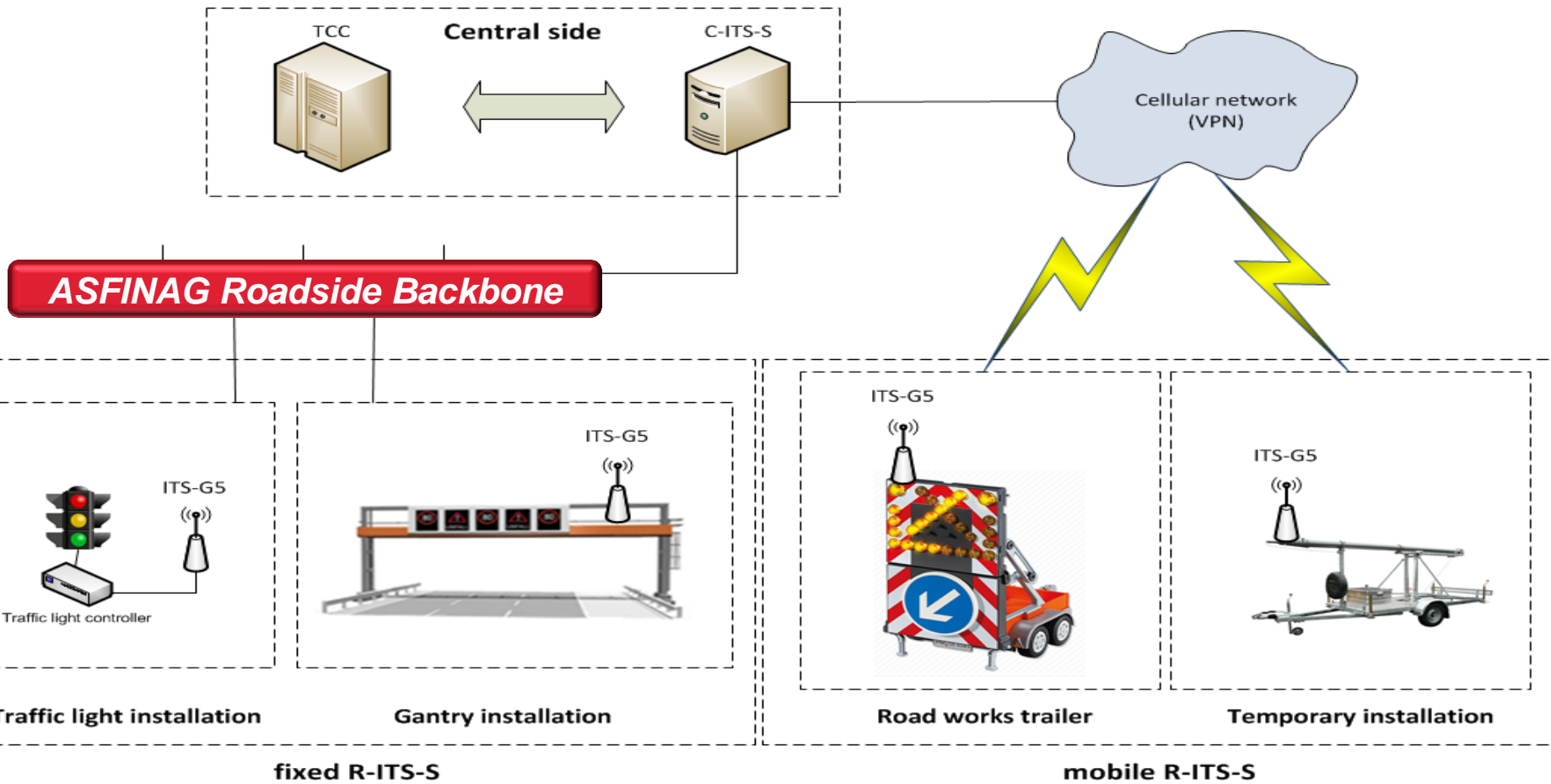


European Corridor – Austrian Testbed for Cooperative Systems

- *Eco-AT*: Austrian project coordinated by ASFINAG, to create harmonised and standardised cooperative ITS applications jointly with partners in Germany and the Netherlands.
- **Living Lab** activities: planned sessions to test and adapt *Day 1* use cases in cooperation with industry partners.



C-ITS Corridor: System Architecture



ETSI standard: testing in EMEA by FCA

Cooperative awareness message
periodically triggered

CAM - vehicle information:
location, speed, heading,
station type, exterior lights, ...



In-vehicle information
information triggered

IVI - road information:
fixed road signs, dynamic
message signs, text, ...



Decentralized environmental notification message
event triggered

DENM - event information:
type (e.g. RW, accident,
adverse weather), location,
duration, ...



Signal phase and timing / Map
periodically triggered

SPaT / MAP
traffic light information: signal
phase, timing, road topology,
...



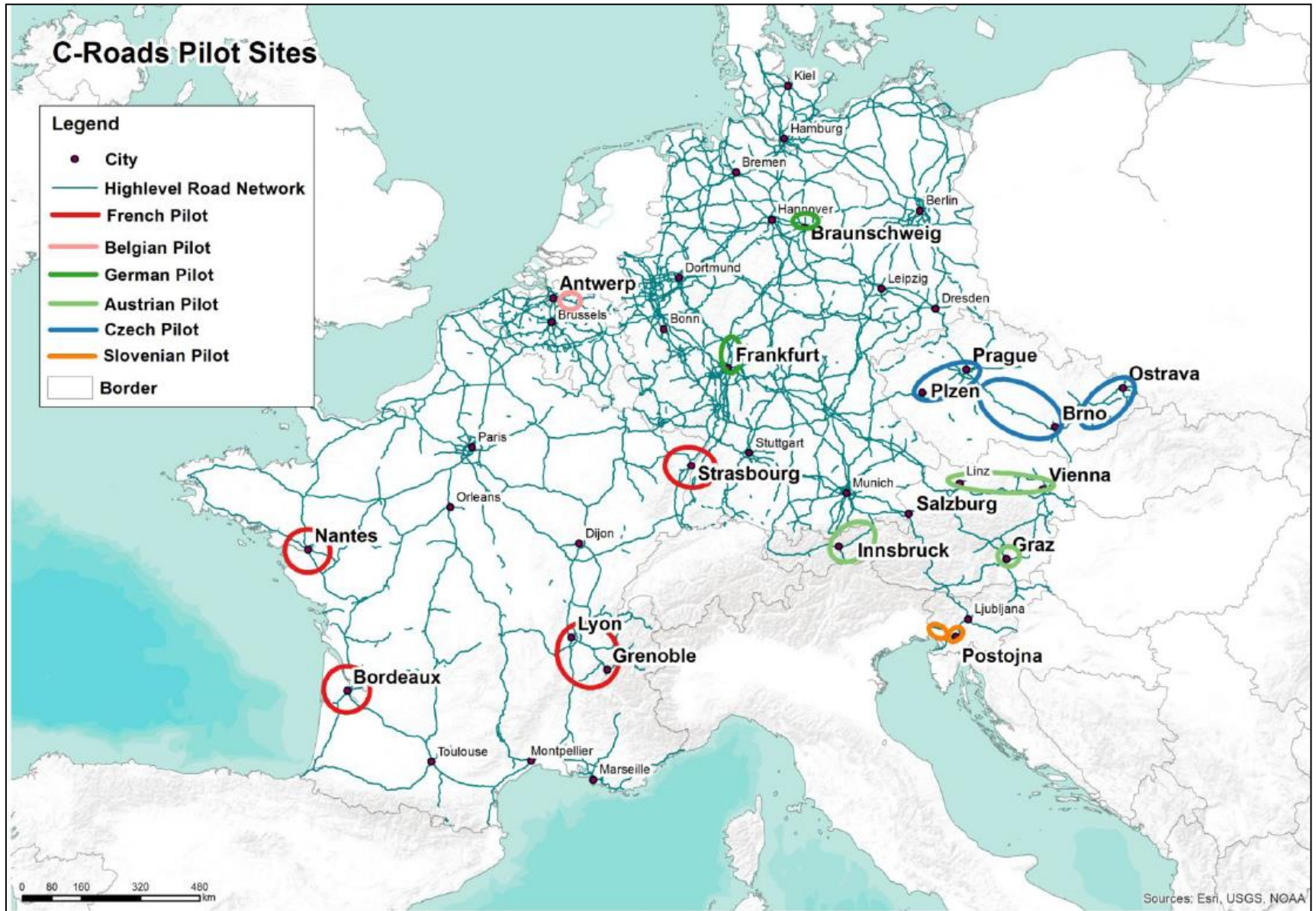
Widening C-ITS to EU Member States

- ❑ Member States across Europe will install C-ITS pilot sites needed for the testing and later operation of “*Day-1-Use-Cases*”.
- ❑ Member States will invest in their infrastructure, OEMs and the industry will use that pilot test infrastructure to test systems and services.
- ❑ **Focus is on ETSI-ITS-G5 and Hybrid Communication Network.**

C-ROADS 2016

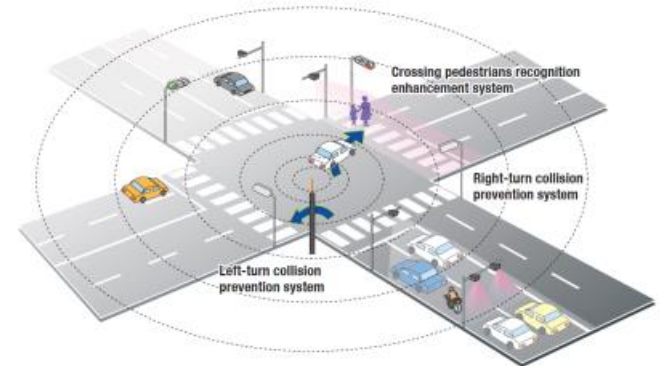
- ❑ Funded by the EC DG MOVE in “Connecting European Facilities”.
- ❑ Total EU funding: 40 M €.
- ❑ Total cost: 68 M €.
- ❑ Partners: Austria, Belgium, Czech Republic, France, Germany, Slovenia - Netherlands, U.K.
- ❑ Coordination of C-Roads Platform: Austria.
- ❑ Project start/end: Feb. 2016, Dec.2020.

C-ROADS 2016: Test Pilot



Integration of digital vehicles on digital roads, enabled by advanced ICT solutions

- ❑ Based on cooperative systems technologies (**V2X based**) to *power-on* the SMART city and the future mobility
- ❑ Create in the Province of Trento the **High Tech Pole on Cooperative-IT Systems** for safe, efficient and smart mobility, working on development and experimentation with new generation ICT Technologies.
- ❑ Partners: CRF, Univ. of Trento, FBK, Create-Net, local ICT and Mechatronic industry, Trentino Network, Trento city hall and Province of Trento.
- ❑ Initiative Benefits for Citizens: Social, Environmental, Economical, Education



Thank you for your attention

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