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

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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.
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
V2X evolution in Europe

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.
C-ITS Platform

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](#))

[Diagram of C-ITS Platform with sections for C-ROADS, C-ITS Platform, ITS Directive Delegated ACT, EU C-ITS Strategy, and Deployment Framework]
C-ITS Platform: Stakeholders

- Automotive Industry: 17.50%
- C-ITS relevant European Sector Associations: 8.75%
- Indiv Expert: 7.50%
- Insurance Companies: 7.50%
- Local/Regional authorities: 7.50%
- Member States: 5.00%
- Road Infrastructure managers: 5.00%
- Service Providers: 25.00%
- Telecommunication Industry: 6.25%
- Tier 1 suppliers: 1.25%
- User’s Associations: 8.75%

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C-ITS Platform: *Day 1 services*

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”)
C-ITS Platform: *Day 1.5 services*

**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

- Front/Rear park sensors
- Long range frontal sensors
- Lane detection sensors
- Blind spot sensors
- V2X virtual sensor
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
Use Case: In Vehicle Signage

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.

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

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

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**Step #1** V2V generated event

**Step #2** V2V received event
C-ITS Corridor

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)
C-ITS Corridor: Eco-AT Living Lab

**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: V2X role

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, ...

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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.

C-ROADS 2016: Test Pilot

C-Roads Pilot Sites

Legend
- City
- Highlevel Road Network
- French Pilot
- Belgian Pilot
- German Pilot
- Austrian Pilot
- Czech Pilot
- Slovenian Pilot
- Border

Sources: Esri, USGS, NOAA

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CRF System Initiative: *Digital Vehicles on Digital Roads*

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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