CONCORDA
-Connected Corridor for Driving Automation-

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CONTENT:

- Summary
- Overall Activity and objectives
- Partners activities
- Expected results
CONCORDA

GA No. M2016/1364071

• contributes to the preparation of the European motorways for automated driving and high density truck platooning with adequate connected services and technologies.

• the main objective of the Action is to assess performances (reliability/availability) of hybrid communication systems, combining 802.11p and LTE under real traffic situations.

• interoperability and continuity of services: the specifications (new or evolved standards) will be applied on all test sites according to the C-ITS Platform recommendations in order to guarantee the interoperability and continuity of services piloted in the CONCORDA project aiming at EU-wide interoperability of services.

• in particular, CONCORDA **will respect** all C-ITS services deployed within the C-Roads initiative and **will ensure** that newly deployed C-ITS services or C-ITS services using new communication systems (e.g. LTE-V2X) **will not affect** existing services in terms of interferences and interoperability.
CONCORDA for Connected Corridor for Driving Automation

CONNECTED CORRIDORS FOR DRIVING AUTOMATION

Predeployment of ITS use cases
- Highway Chauffeur
- Truck Platooning

Hybrid communication mix of two short range V2X systems, i.e. ETSI ITS-G5 and LTE-V2X PC5 in combination with cellular 4G/LTE to achieve C-ITS interoperability, plus network edge computing capabilities

7 Pilot sites in 5 member states of the European Union (Be,NL,FR, GE,SP)

26 Project Partners from Europe, associates from Japan & USA Road Authorities, Automotive Sector, Telecommunications Sector and Universities / R&D Institutions; coordinator: ERTICO

Co-financed by the European Union
Connecting Europe Facility

39 months duration
10/2017 - 12/2020
20 million € budget, 50% co-financed by the EU
6 main activities with 34 milestones
CONCORDA for Connected Corridor for Driving Automation

DT
Nokia
Telefonica
Ericsson
Huawei
GSMA

Fiat
PSA
Peugeot Citroën
Renault
Toyota
Daimler

Bosch
KPN
Kapsch

NXP
TASS
OPNT
Escrypt
Multitel
Autoliv
Denso

MOW
Ministerie
DGT
MIT
French Min
German Min

CTAG
ERTICO
ICCS
IMEC
KUL
TU/e
CRF

Roadside Unit
High level architecture

- RSU development
- LTE-V & MEC

Hybrid communication:
- Short-range ITS-G5
- Short-range LTE-V
- Cell-based LTE

≈ MNO involvement
System overview

Internet

TMC

OEM Back end

Central stations

Regional standards

DATEX II

TPEG & Sensoris

RSU

MEC

CAM: Cooperative Awareness
DENM: Decentralized Environmental Notification Message
SPaT: Signal Phase and Timing
TOPO: Topology
ESM: Embedded Signage Message (including speed limit)
5 Pilot Sites
Pilot site: Belgium

Motorway E 313 – E 34

- 2-3 lanes
- > partly equipped with VMS / Lane Indicator Signs  > (dynamically managed) bus lane
- Extension into the urban area (main penetration roads)  > connection to Smart Cities Antwerp initiative

• Option: E19 (A1) & segments Antwerp Ring Road (R001)  > 2-3 lanes
  > 4-6 lanes, Incl. VMS / LIS
**Pilot sites NL: DUTCH TULIP**

**PS AMSTERDAM**
**PS NOORD-BRABANT**
**PS HELMOND**

1. Highly dense truck platooning from the port of Rotterdam towards Belgium (Antwerp) and Germany (Ruhr-area) in 2019.

2. Connected and automated driving (L3-4) that will communicate with each other and the infrastructure.

3. Transition of Traffic management.

Connecting the main ports within the Netherlands with the green ports, brain ports. And we would like to cooperate internationally with Belgium and Germany.

**Bundling the work: C-ITS corridor, Intercor, Concorda, ...**

- Work together with industry, European Commission and Member states.
Pilot site: Spain
SISCOGA4CAD ITS-CORRIDOR

- ITS Corridor of more than 430 Km of Urban (Vigo) and Intercity roads (AP9, A52, A55)
- ITS GS: 5G RSU
- Cellular: 3G/4G and LTE/V2X/MEC, 5G
- Connected with Portuguese ITS Corridor
Pilot site: France

- **Offer V2X testing**
  - Three independent networks (Optical Fiber)

Available networks:
- G5 Technology
- 2G/3G/4G
- 4G (LTE-V)
- 5G
Pilot site: Germany

Motorway A9: 140km

- Special equipped test section for supporting automated driving (landmarks and reflectors for precise positioning)
- Adaptive traffic control systems: Use of dynamic installations which, for example, warn of danger spots and weather-related restrictions, and, in addition, regulate the flow of traffic
- Fast LAN connection: Direct transmission of large amounts of user information via a central point of contact at selected locations of the Digital Test Bed
USE CASE: Truck-platooning (NL & GE)

Interoperability on Digital Test sides:
- Germany, A9
- Netherlands, Helmond

Scope:
- Using ITS-G5 or/and LTE-V
- Secure communication
- Low latency communication
- Communication via MEC
USE CASE: Highway chauffeur

- Hybrid communication architecture/
  - Hybrid IEEE 802.11p & LTE-Uu communication architecture
  - Evaluate IEEE 802.11p and LTE-V mode 4
- Newest communication technologies
- Coexistence
- Connected automated driving services
- Practical, real-life and complex environments (NL&GE&FR&BE&SP)
USE CASE: Highway chauffeur

Use Case 1: Cooperative Adaptive Cruise Control (CACC), “platooning”

- V2V COMMUNICATION

Use Case 2: Green light optimal speed advisory

- V2I COMMUNICATION
- V2V COMMUNICATION

V2V communication:
- LTE Sidelink (PC5)
- IEEE802.11p (ITS-G5)
- LTE to MQTT to (LTE Uu)

V2I communication:
- TLC to TLEX to MQTT to LTE

V2N, V2M and V2X
USE CASE: Highway chauffeur

• KPN/Siemens 5G filed lab Helmond for autonomous driving at the A270 and N270 between Helmond and Eindhoven LTE-V technology is implemented
• Use cases: CACC and GLOSA (V2V and V2I)
Application test
V2X Deployment architecture

1. LTE Sidelink (PC5)
2. IEEE802.11p (ITS-G5)
3. LTE Uu

LTE SIDELINK (PC5)
- Short range
- V2X App
- TLEX
- MEC
- eNodeB
- Long range

IEEE802.11P (ITS-G5)
- Access layer
- Networking & Transport layer
- Facilities layer

LTE Uu
- Long range
- V2X App
- MEC
- TLEX
- eNodeB

Security
- EN 302 637-2
- EN 302 637-3
- EN 302 636-4-1 GN
- TS 102 687 DCC
- EN 302 663 (ITS-G5)

Developed in ENSEMBLE
- Standardized

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Vehicles hardware architecture

- **Vehicle Gateway**
- **Real-Time CACC Platform**
- **HMI Platform**
- **GPS Receiver**
- **Ethernet Switch**
- **ITS Gateway**
- **ITS-G5 & 4G LTE antennas**
- **Logging Laptop**
- **Logging: MOVE CAN**
- **Logging: TCP/IP Traffic V2X Communication**

**Key components:**
- ITS-G5 & 4G LTE
- Ethernet Switch
- ITS Gateway
- GPS Receiver
- Vehicle Gateway
- Real-Time CACC Platform
- HMI Platform
- Logging Laptop
- Logging: MOVE CAN
- Logging: TCP/IP Traffic V2X Communication

**Antennas:** ITS-G5 & 4G LTE
Vehicles hardware architecture

Tools: Real-Time Application Platform (Speedgoat), antennas, HMI Platform, GPS Receiver (U-Blox 6H), and ITS Gateway (APU2D4).
Vehicles hardware architecture

Tools: ITS G5 Antenna and LTE Antenna
Conclusion

**Interoperability - EU-wide interoperability of services:** continuity of services (new or evolved standards) are applied on all test sites according to the C-ITS Platform recommendations in order to guarantee the interoperability and continuity of services piloted.

**Contributes** to the preparation of the European motorways for automated driving and high density truck platooning with adequate connected services and technologies.

**Assess** performances (reliability/availability) of hybrid communication systems, combining 802.11p and LTE under real traffic situations.
Thank you for your attention!
Innovation for tomorrow’s journey.