MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

C-ROADS FRANCE / INDID WEBINAR

Co-financed by the European Union
Connecting Europe Facility

Agenda

14h – Introduction, presentation of the webinar, webconference instructions

Marie-Christine Esposito (DGITM), C-Roads France and InDiD projects coordinator

14h05 - C-ITS, challenges and opportunities for road operators – an international perspective

Eric Ollinger (DGITM), C-Roads France and InDiD projects emeritus coordinator

14h20 – Organisation of French C-ITS projects and their main technical achievements

Emilie Petit (DGITM), technical activity manager of C-Roads France and InDiD projects

14h35 – Hybrid architecture and C-ITS services

Hasnaâ Aniss (UGE) et Jérémy Diez (DGITM), chairs of architecture WG and use cases WG respectively

15h – Panel « urban services in C-ITS »

Moderator : Sylvain Belloche (CEREMA) – projects director autonomous and connected vehicles

Speakers :
***Eric Monceyron,** projects director – digital and connected territory pole, Bordeaux Métropole*
***Lionel Legaie,** head of the « digital development of the territory » department, Eurométropole de Strasbourg*
***Arnaud Calaudi**, innovation pole, Ville de Paris*
***Christophe Brusset**, in charge of « innovations for transport », Métropole Aix-Marseille-Provence*
***Mirana Ramiandramanjato**, head of « mobility observatory » service, Aix-en-Provence*

Agenda

15h45 – Impacts studies results of C-Roads France project

Antonio Freitas (UCA), chair of impact studies activity of C-Roads France and InDiD projects : **overview of impact studies**
Hasnaâ Aniss (UGE) : **Coopits technical evaluation**
Mehdi Chahir (DIR Ouest) : **Coopits acceptability evaluation**
Lara Désiré (CEREMA) : **Evaluation of the distraction of the on-board C-ITS application for road operators**
Divitha Seetharamdoo (UGE) : **electromagnetic waves exposition evaluation**
Pierre-Antoine Laharotte (UGE) : **Traffic and environmental impacts**
Virginie Taillandier (SNCF) **: Behavioral impacts of railway level crossings use-cases**

17h – French start of operations

Marie-Christine Esposito (DGITM), C-Roads France and InDiD projects coordinator

17h15 – Panel « industrialisation of C-ITS, constraints and opportunities »

Moderator : Xavier Delache (DGITM) – head of the department « usages transition and digitalisation »

Speakers :
Frédéric Joly, *Renault, next generation connected vehicles expert*
Vincent Abadie, *Stellantis, VP – senior expert ADAS & AD*
Laurent Bessou*, VINCI Autoroutes, innovation technology director*
Pascal Philip*, APRR, technologies and traffic safety director*
Jean-Christophe Maisonobe*, département de l'Isère, InDiD project manager*
Luc Laroche*, SNCF,* innovation railway systems programs director
Laurent Cebulski*, EPSF, general director*

18h – Conclusion

Sandrine Chinzi (DGITM), road mobility director

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

C-ITS
Challenges and opportunities for road operators
An international perspective

Eric OLLINGER
Head of the departement of Ecological transition,
Technical Doctrine and Expertise
Directorate for Road Mobility

Cooperative ITS

- Intelligent transport systems (ITS) : use of information and communication technologies in the field of transport
- Cooperative : based on the exchange of information between vehicles or between vehicle and infratructure. Also called V2X communiation

NB : there are other types of connected vehicles aside V2X communications (multimedia platform of the OEM, eCall, Pay As You Drive insurance…)

Co-financed by the European Union
Connecting Europe Facility

The 3 ways C-ITS can work

- V2V : sensors embedded in the vehicle collect information and transmit them automatically to vehicles behind
- V2I : same, but the information is transmitted to the road operator's traffic control center
- I2V : the road operator sends information that is displayed to vehicles passing by the area of the event

Co-financed by the European Union
Connecting Europe Facility

What is PIARC ?

PIARC is an association aiming at sharing knowledge on road matters at world level (123 member countries)

It works in 4-year cycles through:

- Technical committees
- Task forces
- Special projects

All publications are in 3 languages: English, French, Spanish

Every 4 years, PIARC organizes the world road congress and the world winter service congress

Co-financed by the European Union
Connecting Europe Facility

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

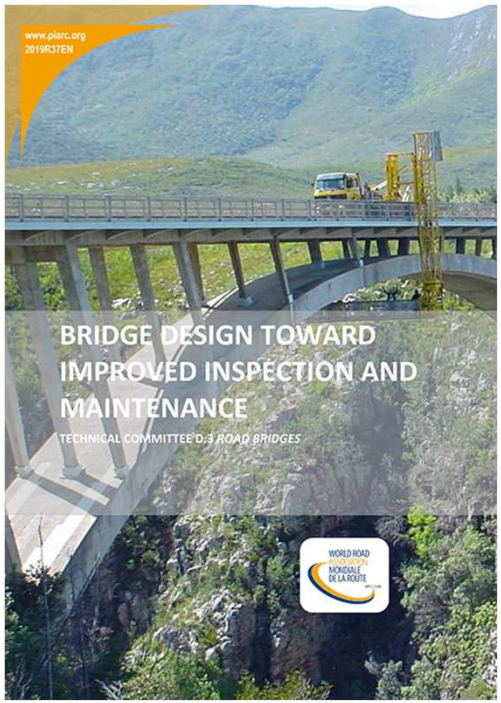
InterCor

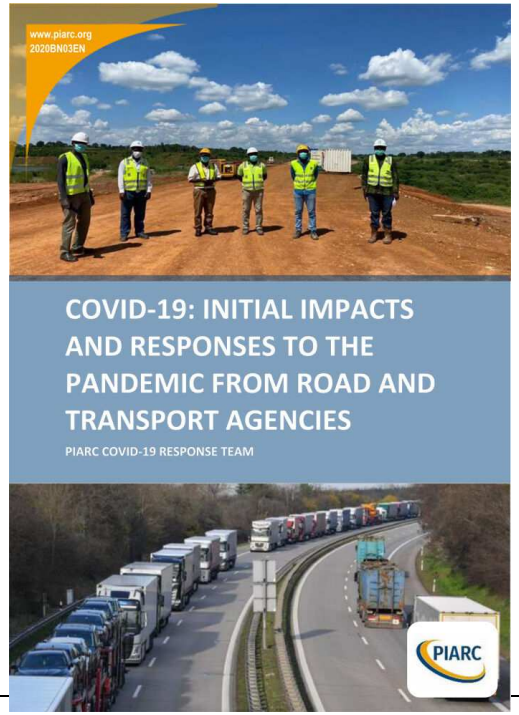
C-ROADS FRANCE

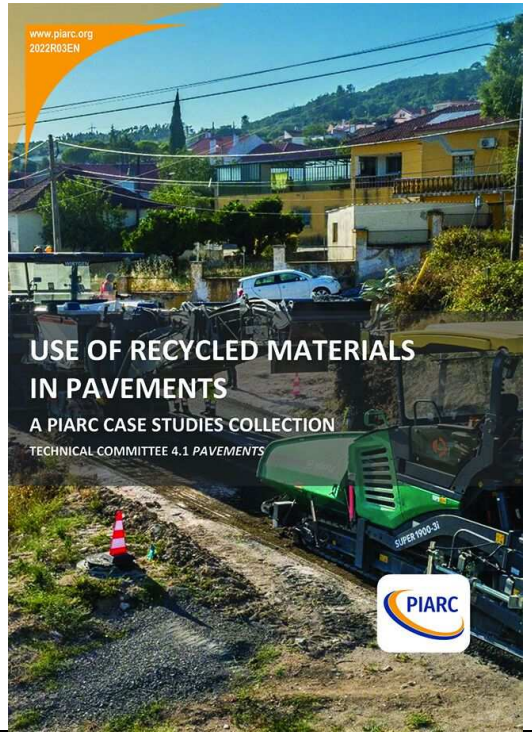
InDiD
Infrastructure Digitale de Demain

PIARC

Examples of PIARC publications

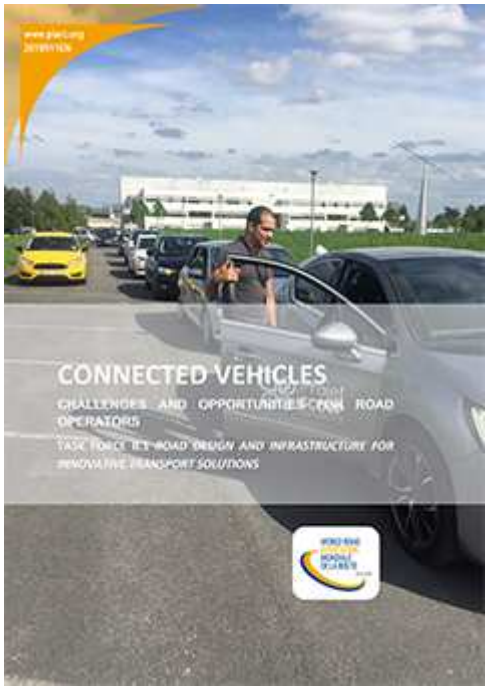






Co-financed by the European Union
Connecting Europe Facility

The PIARC report on connected vehicles



Connected vehicles: challenges and opportunities for road operators

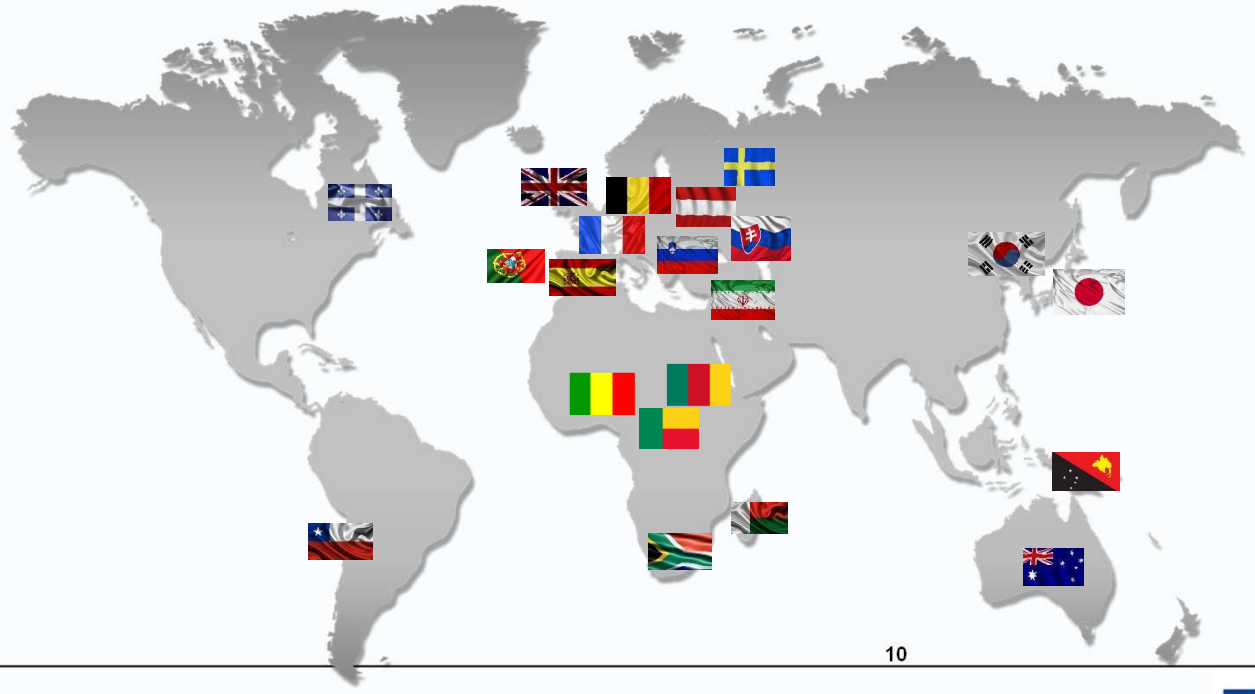
Published 2019

Result of the work of a task force during 2 years

Co-financed by the European Union
Connecting Europe Facility

Members of the task force

29 experts from 21 countries



Co-financed by the European Union
Connecting Europe Facility

Opportunities of C-ITS for road operators

- Road safety is key (high expectations)
  - Collision Reduction, Protection for Vulnerable Users, Traffic Condition Warning, Safety of Road Workers in the Field…..
- Greenhouse effect gas emissions (monitoring and, at high penetration rates, reduction)
  - Traffic monitoring using Probe vehicle data, Green Light Optimal Speed Advisory (GLOSA), Smart Routing….

Co-financed by the European Union
Connecting Europe Facility

Opportunities of C-ITS for road operators

- Improvements in traffic monitoring, event management, traffic management and Road Network Operations in general (increase/optimization of capacity)
- Improved traffic information (road works, road condition, weather conditions, diversions….)
- Being prepared for future challenges in automation
- Infrastructure planning: optimizing the road design to the real use of the road (real traffic conditions for pavement design, O/D information for planning)

Co-financed by the European Union
Connecting Europe Facility

Challenge #1
Functional and technical interoperability

INTEROPERABILITY

to ensure that the same standards and specifications are used when deploying systems

Best practice : the formation of open governance groups across jurisdictions and across technical and strategic C-ITS aspects, particularly in Europe and in the USA

Co-financed by the European Union
Connecting Europe Facility

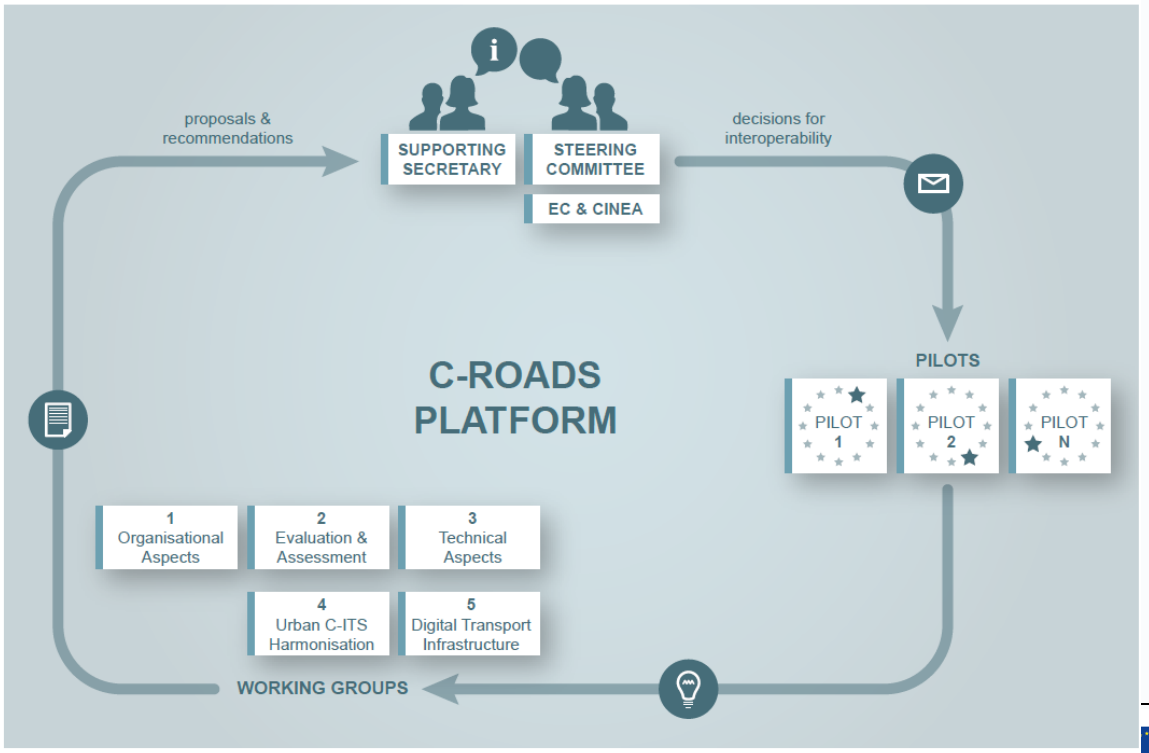
MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
Liberté
Égalité
Fraternité

Functional and technical interoperability

C-ROADS

Co-financed by the European Union
Connecting Europe Facility

Functional and technical interoperability



Co-financed by the European Union
Connecting Europe Facility

Challenge #2
Choice of the services to deploy

The European Commission has identified an agreed list of Day 1 and Day 1.5 services for short term deployment across Europe.

The two tables list the European Day 1 and Day 1.5 service lists. The tables also indicate the associated common communication types and primary services utilized to bundle the services

Co-financed by the European Union
Connecting Europe Facility

Choice of the services to deploy

#	Day 1 Services			Bundle
1	Emergency electronic brake light	V2V	Safety	1
2	Emergency vehicle approaching	V2V	Safety	1
3	Slow or stationary vehicle(s)	V2V	Safety	1
4	Traffic jam ahead warning	V2V	Safety	1
5	Hazardous location notification	V2I	Motorway	2
6	Road works warning	V2I	Motorway	2
7	Weather conditions	V2I	Motorway	2
8	In-vehicle signage	V2I	Motorway	2
9	In-vehicle speed limits	V2I	Motorway	2
10	Probe vehicle data	V2I	Motorway	2
11	Shockwave damping	V2I	Motorway	2
12	GLOSA / Time To Green (TTG)	V2I	Urban	3
13	Signal violation/Intersection safety	V2I	Urban	3
14	Traffic signal priority request by designated vehicles	V2I	Urban	3

Co-financed by the European Union
Connecting Europe Facility

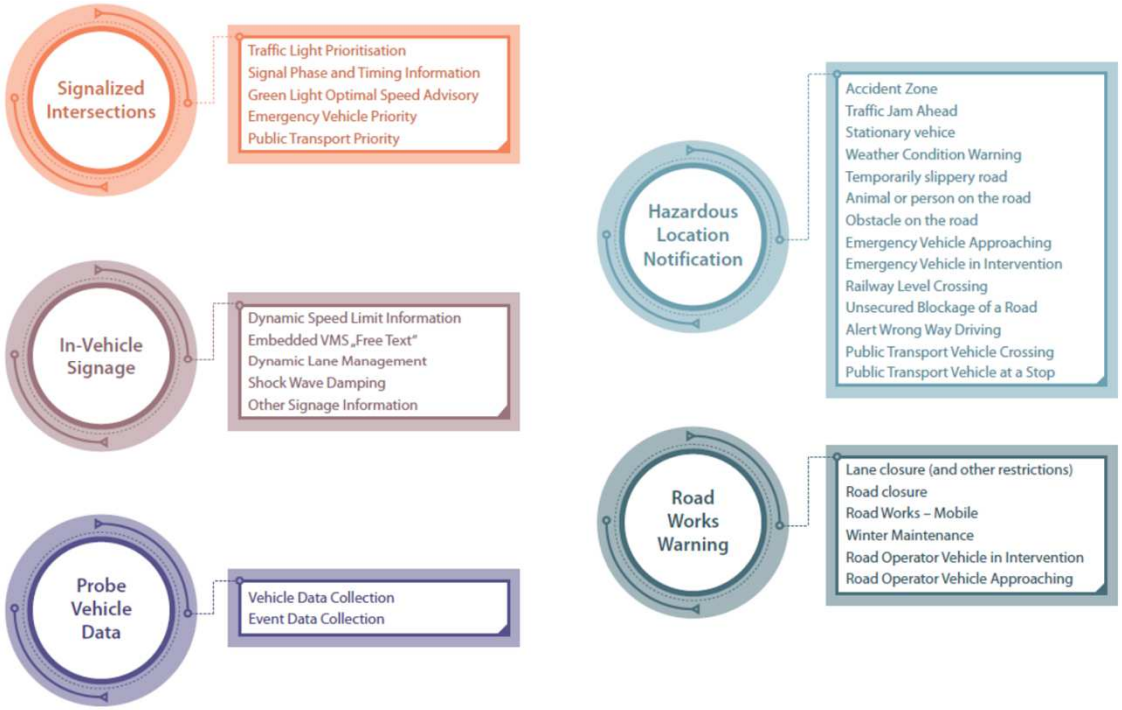
Choice of the services to deploy

#	Day 1.5 Services	Bundle		
1	Off street parking information	V2I	Parking	4
2	On street parking information and management	V2I	Parking	4
3	Park & Ride information	V2I	Parking	4
4	Information on AFV fueling & charging stations	V2I	Smart Routing	5
5	Traffic information and smart routing	V2I	Smart Routing	5
6	Zone access control for urban areas	V2I	Smart Routing	5
7	Loading zone management	V2I	Freight	6
8	Vulnerable road user protection (pedestrians and cyclists)	V2Others	VRU	7
9	Cooperative collision risk warning	V2V	Collision	8
10	Motorcycle approaching indication	V2V	Collision	8
11	Wrong way driving	V2I	Wrong Way	9

Co-financed by the European Union
Connecting Europe Facility

Choice of the services to deploy

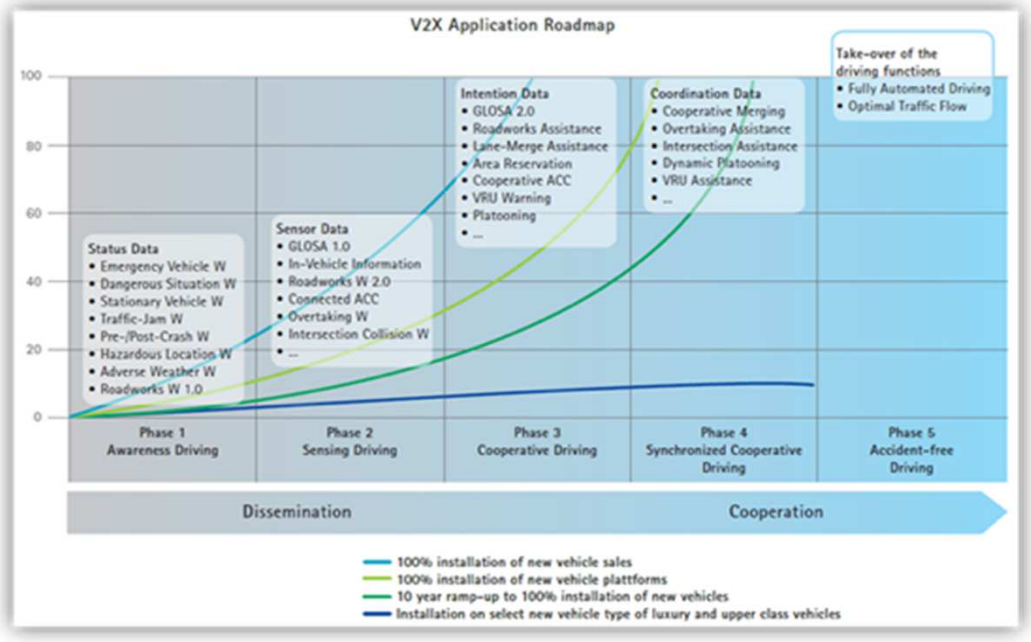
C-ROADS



Co-financed by the European Union
Connecting Europe Facility

Choice of the services to deploy – longer term

There is a recognition that the provision of certain services can be associated with the increasing levels of automation



V2X applications from the perspective of the C2C Communication Consortium

Co-financed by the European Union
Connecting Europe Facility

Challenge #3
Business model

Identification of the value chain, and of cash-flows between stakeholders :

- Road users and travellers
- Road and traffic operators:
- Public authorities:
- C-ITS technology providers
- ITS service providers and operators.
- Automotive suppliers and OEMs (Vehicle manufacturers): some provide Connected Vehicle services and collect probe vehicle data which can be used by ITS service providers.
- Wireless communications and digital infrastructure providers.
- Third parties: includes information service providers, insurance providers, public transport operators, Emergency Services and traffic generators such as big businesses, large and/or regular events, and shopping centres.

Co-financed by the European Union
Connecting Europe Facility

Challenge #4
Choice of technology

Short range ?

PROS

Short range communication is most suitable to broadcast tactical information that needs to be spread quickly and very near to the information location.

CONS

Short Range Communication requires a large network of Road Site Units, which implies significant investment and the need for very open standards in order to allow future upgrades to the system and to limit technological obsolescence

Co-financed by the European Union
Connecting Europe Facility

Choice of technology

Long range ?

PROS	CONS
Long range communications are highly suited to strategic information broadcasts and the coverage and capacity of cellular networks are growing as technology continues to evolve	Restricted data transmission rates and latency can be an obstacle in some locations Human Machine Interface (HMI) design needs to guarantee that distraction is not induced.

Co-financed by the European Union
Connecting Europe Facility

Choice of technology

Hybrid

Due to the varying requirements for different C-ITS services and applications, the open hybrid approach may be the most appropriate scenario to allow future growth.

Approach used in C-ROADS

Co-financed by the European Union
Connecting Europe Facility

Challenge #5

Security and privacy

- Security needs to be ensured along the whole service chain from C-ITS service generation towards C-ITS service presentation to the single user
- Frequency of change of pseudonyms
- Anonymization by the road operator
- Information sent from road and traffic operators' vehicles

Co-financed by the European Union
Connecting Europe Facility

Challenge #6

Promotion of the services

It is necessary for road users, the end-users of C-ITS services, to understand the available services and recognize the advantages through direct and indirect participation, and thereby encourage ongoing utilization

GOOD EXPERIENCE in JAPAN:

Satisfaction survey conducted by The National Institute for Land and Infrastructure Management (NILIM)

Co-financed by the European Union
Connecting Europe Facility

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE
Liberté
Égalité
Fraternité

And here are the results…

C-ROADS

Thanks for your attention

Co-financed by the European Union
Connecting Europe Facility

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

ORGANIZATION OF FRENCH C-ITS PROJECTS

C-ROADS WEBINAR – 8 MARS 2021

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

Former Cooperative ITS Pilot Deployment Projects

SCOOP : 2014-2019

- 1st wave (pilot deployment) : 2014-2017
- Priority services
- ITS-G5 Wi-Fi communications
- 2nd wave (proof of concept): 2016-2018
- New services
- Hybrid Communications : Cellular/WiFi ITS-G5
- Deployment: on a large scale, in real conditions, with the constraints of real life
- Vehicles sold to real customers => privacy by design with CNIL and ANSSI
- Constraints of series production for manufacturers
- Each road manager makes its contracts

InterCor : 2016-2020

- Addition of logistics services
- Interoperability with 3 other countries
- Interoperable Security
- Cellular

Currents projects

C-Roads France : 2016-~~2020~~ 2021

- News services (urban)
- Smartphone app
- Harmonization at European level – C-ROADS Platform

InDiD : 2019-2023

- Extension of deployment to new sites
- Updating deployments on sites already equipped
- Addition of new services, in particular in anticipation of the VA, but also at the interfaces with public transport, logistics, rail
- Work on digital HD cartography
- Improvement of road managers' IS for VC and VA services
- Preparing the way to 5G

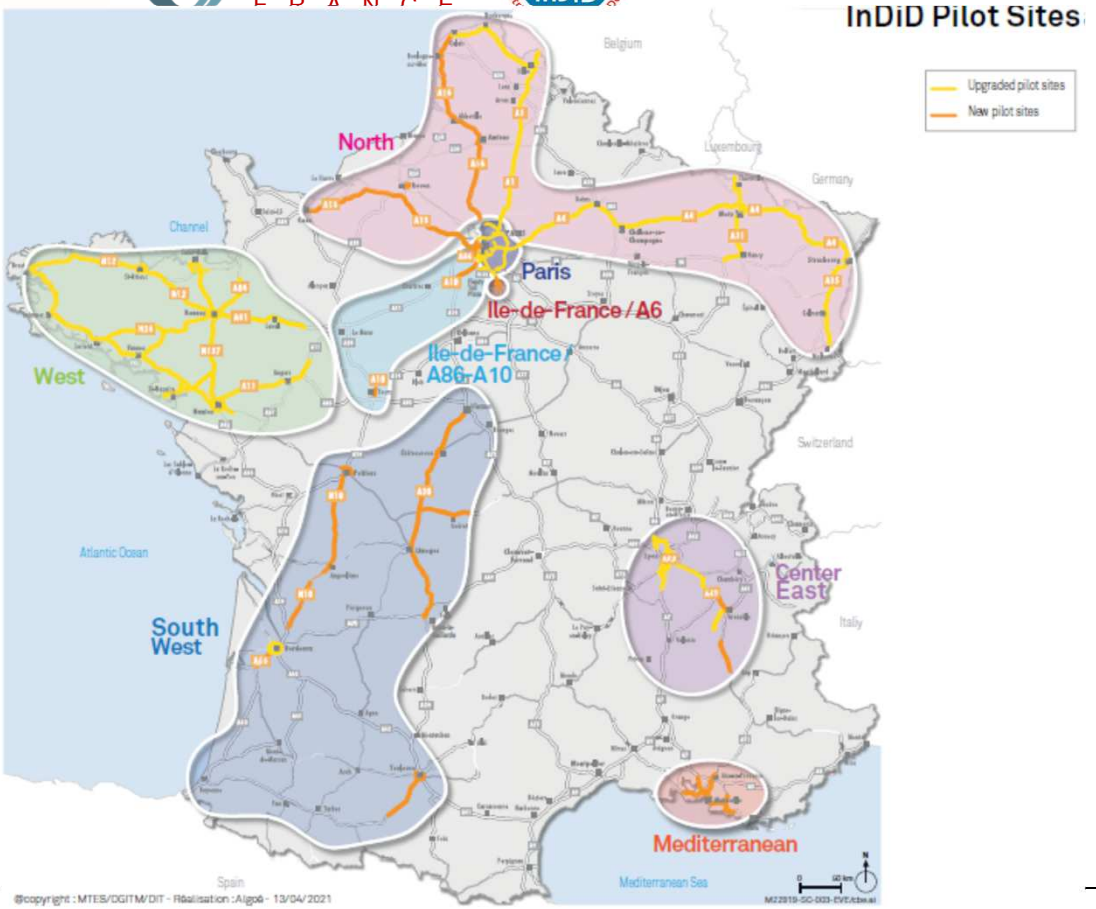
C-ITS maps in France

Highways

National roads

Departmental Roads

Urban Roads



Partners involved in french projects: SCOOP/INTERCOR/C-ROADS/INDID

The **Ministry in charge of Transport** (Department of Transport Infrastructure)

Local authorities (Department of Isère; and in association with ITS Bretagne: Department of Côtes d'Armor, d'Ille et Vilaine, Région Bretagne, Saint- Brieuc Agglomération, Bordeaux métropole, Eurométropole de Strasbourg, Métropole Aix- Marseille Provence, Métropole de Grenoble, SMTC, Ville de Paris)

Managers of the **national road network** (DiRIF, DIRA, DIRO, DIR Nord, DIR Est, DIR CE, DIR Med, DIR CO, DIR SO, SANEF, Vinci, APRR)

Car manufacturers (PSA, Renault)

An equipment manufacturer (Valeo)

A public transport operator (Transdev)

Universities and research centers (Cerema, University Gustave Eiffel, GIE RE PSA-Renault, University of Reims Champagne-Ardenne, Institut Mines-Télécom, University Clermont-Auvergne, University of Valenciennes, Bordeaux INP, Eurecom, Vedecom, IGN)

A **telecommunication** operator (Orange) and communication network system providers (Green communication, ATC France)

An IT **security specialist** (IDNomic)

Logistics specialists (neoGLS, iTrans, MGI)

Mobility laboratories (Transpolis)

A service provider (TOMTOM)

Associated partners: SNCF, OCSTI, Atlandes, Geo-Sat

4 - Projet Management
Pilote : Marie Christine ESPOSITO (DGITM)

4.1 Project management	4.2 Communication

1 - C-ROADS Platform
Pilote : Marie Christine ESPOSITO (DGITM)

WG1 – C-ITS organisation Eric PILLET
WG2 -Technical aspects WG2 / Emilie PETIT (DGITM) TF1 / Guillaume RICHARD (ATOS) TF2/Jérémy DIEZ (DGITM) TF 3/ Jérémy DIEZ(DGITM) /Geoffrey WILHEM (URCA) TF 4 / Hasnaâ ANISS (UGE) /Hacène FOUCHAL (URCA) TF5 / Marwane AYAIDA/Yassin El HILLALI (URCA)
WG3 - Evaluation & Assessment Gérard CHALHOUB (UCA)
WG4 – Urban C-ITS Operation (City forum) Paul Guillemard (CEREMA)
WG5 – Digital Transport Infrastructure Frédérique Williams (IGN)

2 -Technical Aspects
Pilote : Emilie PETIT (DGITM)

2.1 – Technical coordination Emilie PETIT (DGITM)/ Anaïs DUCOURNAU (Viveris)
2.2 – Service Definition Jeremy DIEZ(DGITM)
2.3 – Impacts studies and evaluation Antonio FREITAS (UCA)
2.4 – Specifications Antoine FOULQUIE (Viveris)
2.5 – Dévelopment Romain MOREL (Viveris)
2.6 – Validation Pierre DUBOIS (Viveris)
2.7 – Transversal studies Emilie PETIT (DGITM)

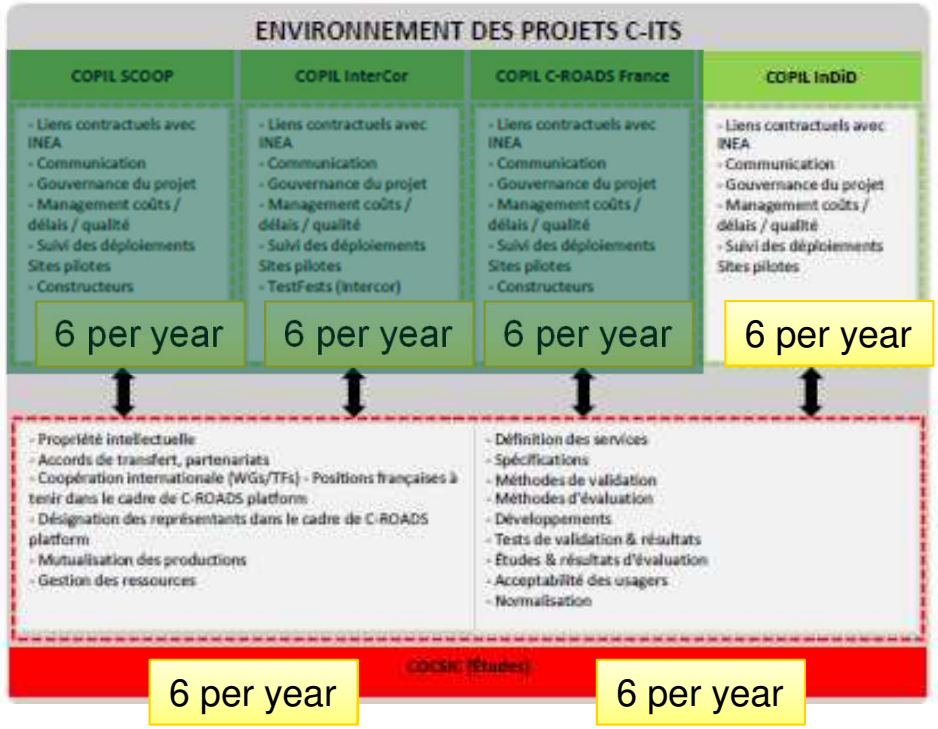
3 - Pilot Operations

Pilot North-East Malalatiana RANDRIAMASY (SANEF)
Pilot Centre-East Benoit VUADELLE (APRR)
Pilot South West Isabelle DUARTE (DIRA)
Pilot West Katell KERDUDO (DIRO)
Pilot Mediterranean Guillaume ROGNON (DIRMED)
Car Manufacturers Saleh Bensator / Farah Breiteh

Activity 4 – Management

- The governance of projects or inter-projects is governed by the following principles: collegiality, subsidiarity and transparency
- Decisions are taken in COPILS or COCSICs (studies).

23 meetings in 2021.
26 C-ROADS steering committees



Activity 1 – C-Roads platform

The C-Roads platform brings together 16 States engaged in pilot deployments (total: 350 M€)

France contributes through these deployment projects to these European Activities:

- contribution to the harmonization of specifications for the purpose of interoperability,
- participation in interoperability tests (Tests fests, Cross border tests…)

A French organization has been set up to ensure European harmonization:

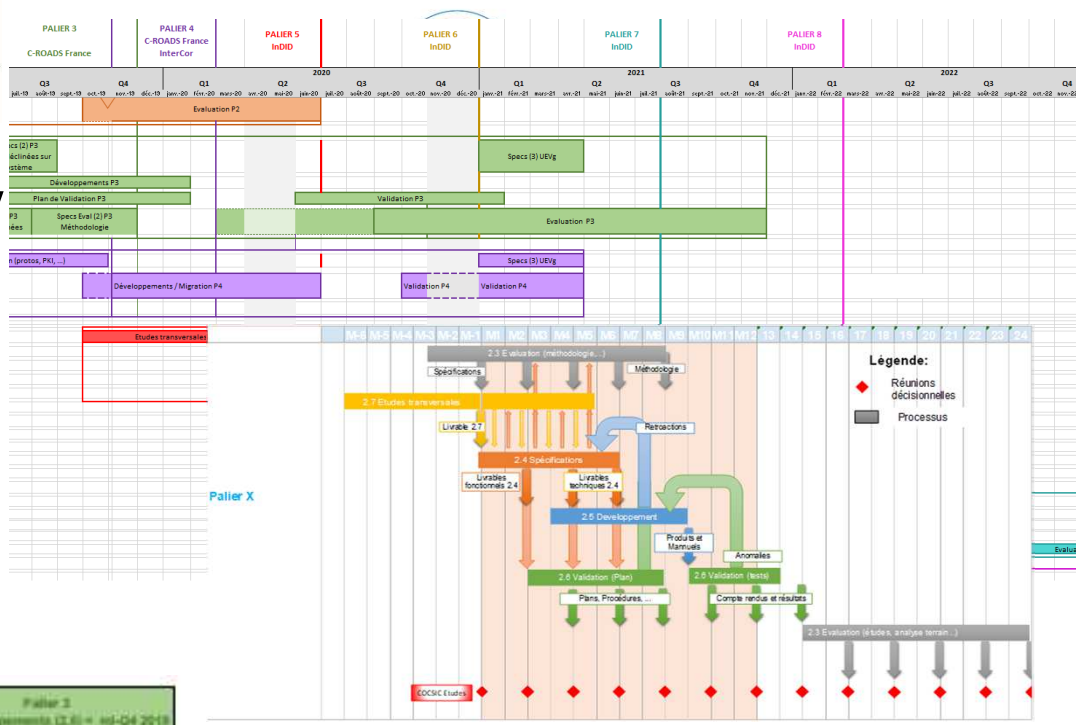
- French position on the decisions taken in COCSIC S.
- Proofreading of European specifications systematically in COCSIC Studies
- Representation of France divided between partners
- Technical contribution as needed in WG/TF

Activity 2 – Technical activity Management tools

Technical activity now fully mutualized

Management tools:

- Schedule Plan
- Roadmap
- Running step by step
- Project monitoring table
- …



Activity 2 – Technical activity
Step 1 - Specifications

Definition of specifications

Functional (2.2) objective to define the use case

Technical (2.4) consisting of GT:

- WG architecture – Hasnaa ANISS (UGE)
- WG use cases – Jérémy DIEZ (DGITM)
- WG national node – Ahmed DIDOUH (UPHF)
- WG Back-office for road managers – Vincent ROBIN (CEREMA)
- WG Hardware Vro-ITS-S – Romain GALLEN (CEREMA)
- WG software Vro-ITS-S – Yohan LE CHANU (Viveris)
- WG smartphone app – Laurent Bessou (Vinci)
- WG Connected P2V – Benoît Vuadelle (APRR)
- WG Security – X (Telecom Paris)

Transversal (2.7): introduce innovations, unblock hard points, coarsening of new subjects

The specifications allow us to fill in the gaps in the standards and to specify the use cases.

They are enriched and polished by the experience of developments and tests

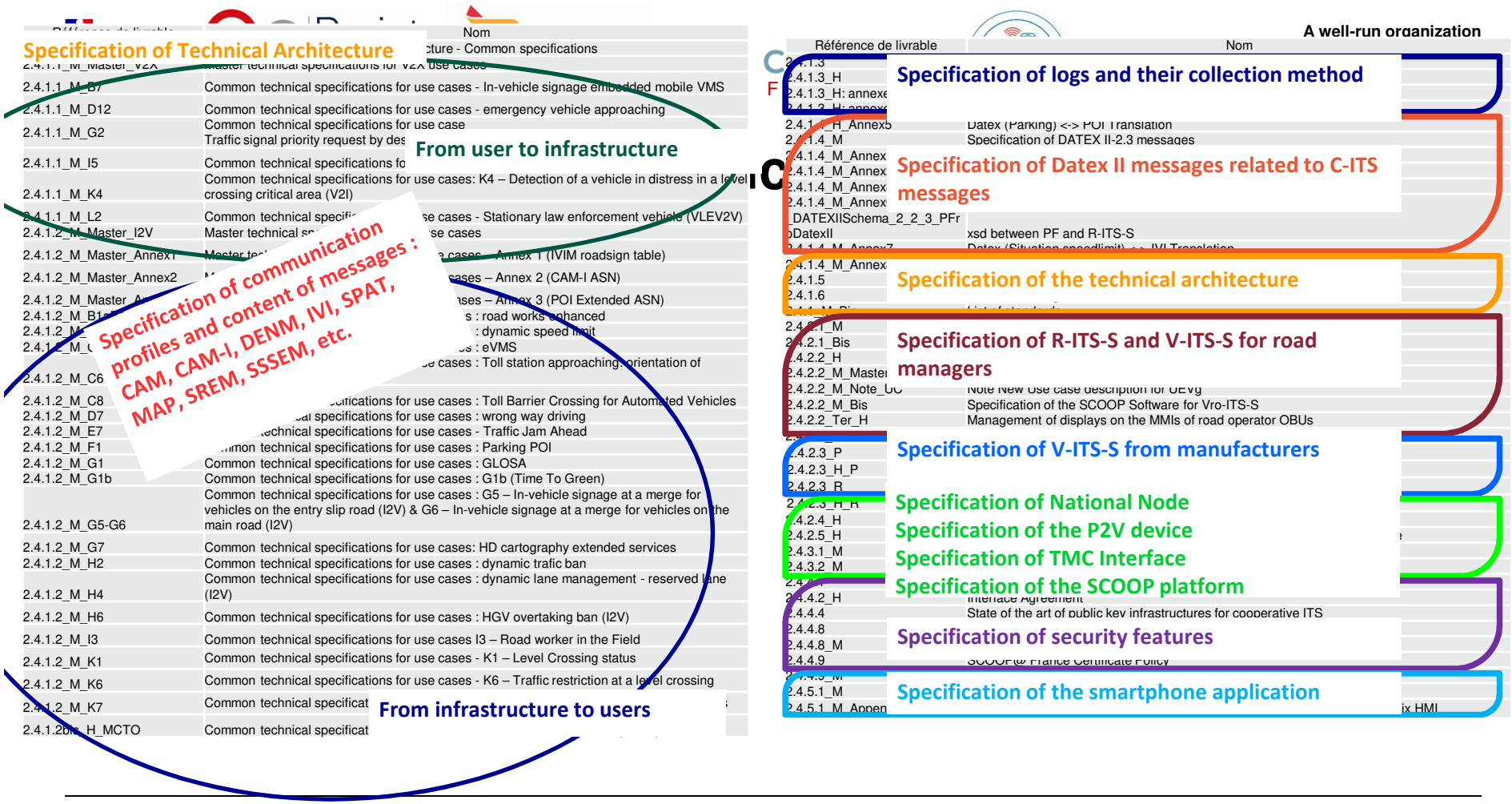
Specifications are harmonized with C-ROADS platform's

The specifications are divided into 5 categories:

- 2.4.1 – general specifications
- 2.4.2 and 2.4.3 categories – individual component specifications
- 2.4.4 category – security feature specifications
- 2.4.5 – specifications of embedded applications

Most are available on the DGITM website.

15 working groups
More than 150 meetings each year
50 deliverables


Specification of Technical Architecture
From user to infrastructure
Specification of communication profiles and content of messages : CAM, CAM-I, DENM, IVI, SPAT, MAP, SREM, SSSEM, etc.
From infrastructure to users
Référence de livrable
Nom
Specification of logs and their collection method
Specification of Datex II messages related to C-ITS messages
Specification of the technical architecture
Specification of R-ITS-S and V-ITS-S for road managers
Specification of V-ITS-S from manufacturers
Specification of National Node
Specification of the P2V device
Specification of TMC Interface
Specification of the SCOOP platform
Specification of security features
Specification of the smartphone application

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Liberté Égalité Fraternité

Projet SCOOP véhicules et routes connectés connected vehicles and roads

InterCor

500 feedback issues
More than 30 coordination meetings each year
50 deliverables / 35 prototypes

Activity 2 – Technical activity
Step 2 - Developments

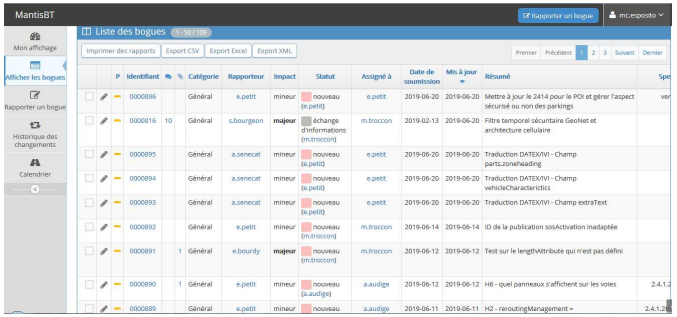
Each partner who develops, is responsible for his own development, and therefore for contracting with one or more suppliers.

The progress of developments is monitored at the national level with

- Version tracking
- Monitoring compliance with requirements
- Support for carrying out bilateral tests between partners

Please note: very little contact between national project and suppliers, this remains the responsibility of the partner.

Feedbacks to specification on issues via a Mantis tool



Delivery of prototypes to validation step

	Gestionnaire	Composants / Interface / Tests interne	MOE / Point de contact	Version / Statu	Date in	Détails	Date livraison	Date installation	Date début Tests local
102	DIRO	**SAGT** SAGACITE - DIRO	Oui	8C	26/10/2021	Version 8C+ (nom de la version à clarifier): Palier 4 : - C3 est développé non receptionné et est à tester en chaine complète. Version 8D: évolution applicative sur la partie configuration référentiel et UCs. Pas d'évolution du périmètre des UCs développés.	8C 25/08/2021	8C 25/08/2021	N/A
103	DIRO	**Pfro** Cegelec Mobility	Non	3.2.02	26/10/2021	- Installation sur les PF de valid. et prod. 3.2.02 le 02/6/2021	3.2.04 TBD	3.2.04 TBD	N/A
104	DIRO	**R-ITS-S** Lacroix City	Oui	4.6.0	08/12/2021	Prod en 4.4.2 Tests en cours à l'URCA: Tests prévu sur la 4.6.1(pour Vinci)	4.6.0 06/08/2021	4.6.0 30/08/2021	N/A
105	DIRO	**Vro-ITS-S** YoGoKo	Oui	4.0	26/10/2021	- **Intégration Briq. Nat.** pour UEVg v1.2: Bus de Com v0 en cours. Fin d'intégration pour fin janvier 2022. - **Hybridation :** en cours de développement chez Yogoko - **Nouvelle archi. Bus de Com :** en cours de développement chez Yogoko - **UCs SCOOP vague 2 & C-ROADS :** Attente Marché National **Bilan véhicule (VI) équipés** : 1 véhicule livrée avec intégration Briq. Nat. avec UTIC NeoGLS. D'autres véhicules équipé des Briq. Nat. ? ==> Aucun à date du	4.1 01/06/2021	4.1 23/07/2021	N/A
106	DIRO	**Enregistrement** PKI migrée	-	En cours	26/10/2021	- R-ITS-S : BN NeoGLS: Fin decembre 2021 Vro-ITS-S : A faire plus tard TBD			
107	DIRO	**Connexion** Nfr-ITS-S (avec Pfro)	-	Fait	13/11/2020	- Connexion au NN de pré prod et prod réalisée			

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

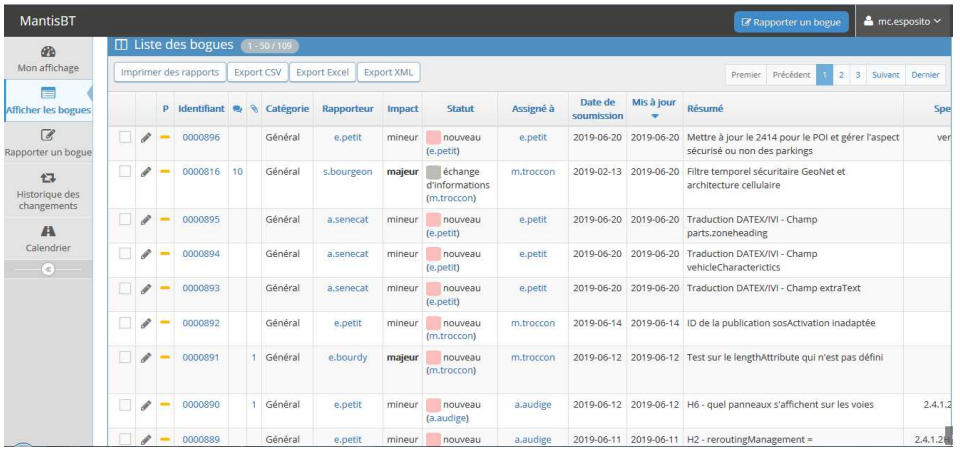
500 feedback issues / 30 anomalies
More than 50 coordination meetings each year
35 deliverables

Activity 2 – Technical activity
Step 3 - Validation

- Development of tests at all levels:
  - write test plans
  - lead the campaigns
  - ensure the production of final reports
- 3 working groups: unitary, interface, complete chain
- 3 environments : on table, on lab tracks, on roads.

Feedbacks of development on anomalies via the mantis tool

Reporting of results on a SQUASH tool



Activity 2 – Technical activity
Step 3 - Validation

Tests	Lab	Test tracks	Open roads
Compliance to standard communication tests	x		
Functional application tests	x		
Logs generation tests	x	x	
Security tests	x		
PKI access tests	x		
Performance testing	x		
Radio coverage		x	
Messages contents	x	x	
SCOOP platform Tests	x		

Tests	Lab	Test tracks	Open roads
Message compliance (R-ITS-S / Vru-ITS-S)	x	x	
Mitigation tests(R-ITS-S / Vru-ITS-S)	x	x	
Radio coverage (R-ITS-S / Vru-ITS-S)		x	
DatexII exchanges (PFro ⇔ R-ITS-S / Vro-ITS-S /Nfr-ITS-S)	x		

Tests	Lab	Test tracks	Open roads
Interoperability messages tests between ITS Station with security	x		
Forward test at a geonet layer level	x	x	
Use cases Tests (including security and log management)			x
Mitigation (at a toll station) tests			x
Latency tests		x	

Activity 2 – Technical activity
Step 4 – Autorisation to production

When partners are confident about the maturity level of a version of a software, they can request the PMA to be authorized to run in operational conditions in a production environment. This is the production release process.

A production release committee meets whenever necessary, to analyze the inputs on the versions of equipment proposed by the partners to be in production on the national territory. It prepares the decision for the PMA.

This role is delegated by PMA to COCSIC Etudes.

The concerned prototypes are all C-ITS equipment developed in C-ITS projects :

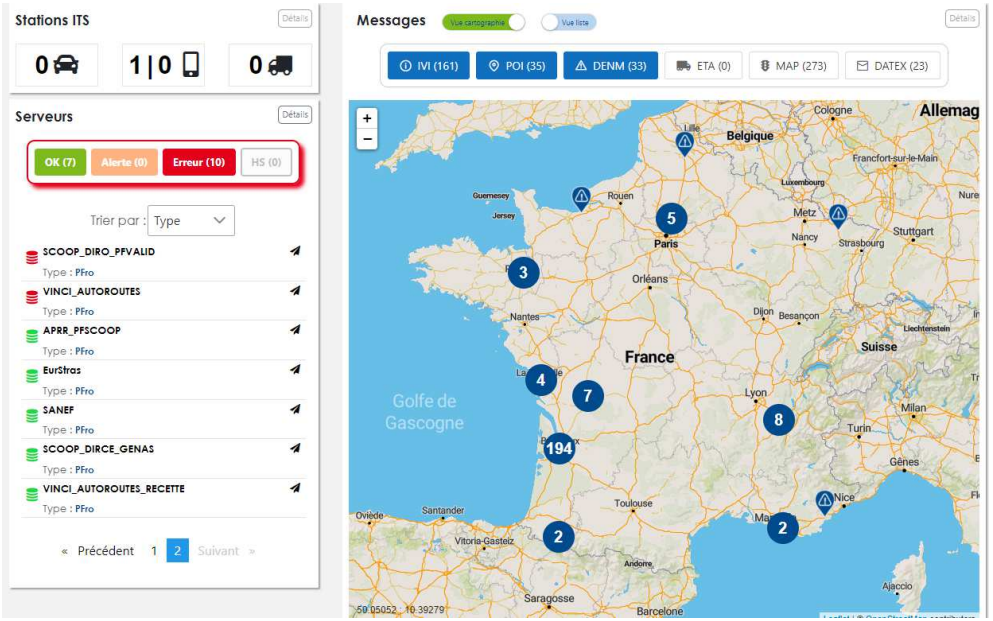
- PFro
- NFr-ITS-S
- R-ITS-S
- Vro-ITS-S
- COOPITS (NAP-SER, LAP-SER, APP-CRO)
- TMS C-ITS interfaces
- Vru-ITS-S

The production release committee performs cross-functional checks on the coverage of requirements by developments and tests and ensures that the tests carried out provide evidence of the proper functioning of the equipment version. The considered version must therefore have passed the relevant test campaigns.

The production release committee prepares the decision for the COCSIC etudes, which gives, or not the authorization.

Activity 3 - Deployments

Once authorized, components are deployed on partners' infrastructures.



More than 30 meetings each year
17 C-ROADS deliverables

Activity 2 – Technical activity
Step 6 – Evaluation

Development of evaluation methodologies then production and publication of the results

These results then feed into the specifications for the continuous improvement of C-ITS

7 Working Groups write the methodologies and – 1 per theme

WG Technical evaluation

WG Organizational impacts and acceptability

WG user behavior and road safety

WG health impacts/electromagnetic waves

WG Traffic and environment

WG legal impacts

WG socio-economic impacts and business models

Conclusion

The current organization for C-ITS projects is well established, and leads to continual deployment of new use cases and the expansion of the scope of coverage of C-ITS in France.

This organization is in a project mode.

We are switching to an industrial organization, the implementation of production committees is a first step.

Architecture, players and services are growing and diversifying...

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Co-financed by the European Union
Connecting Europe Facility

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

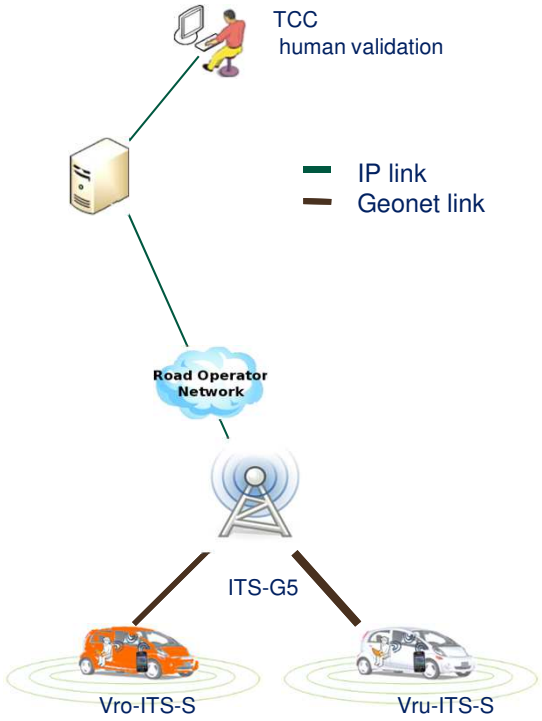
ARCHITECTURE

C-ROADS FRANCE

Hasnaâ Aniss – Université Gustave Eiffel

InDiD
Infrastructure Digitale de Demain

Functional architecture - the beginning



ITS-G5: Based on 802.11p / Geobroadcast or IP / Congestion control (DCC)

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

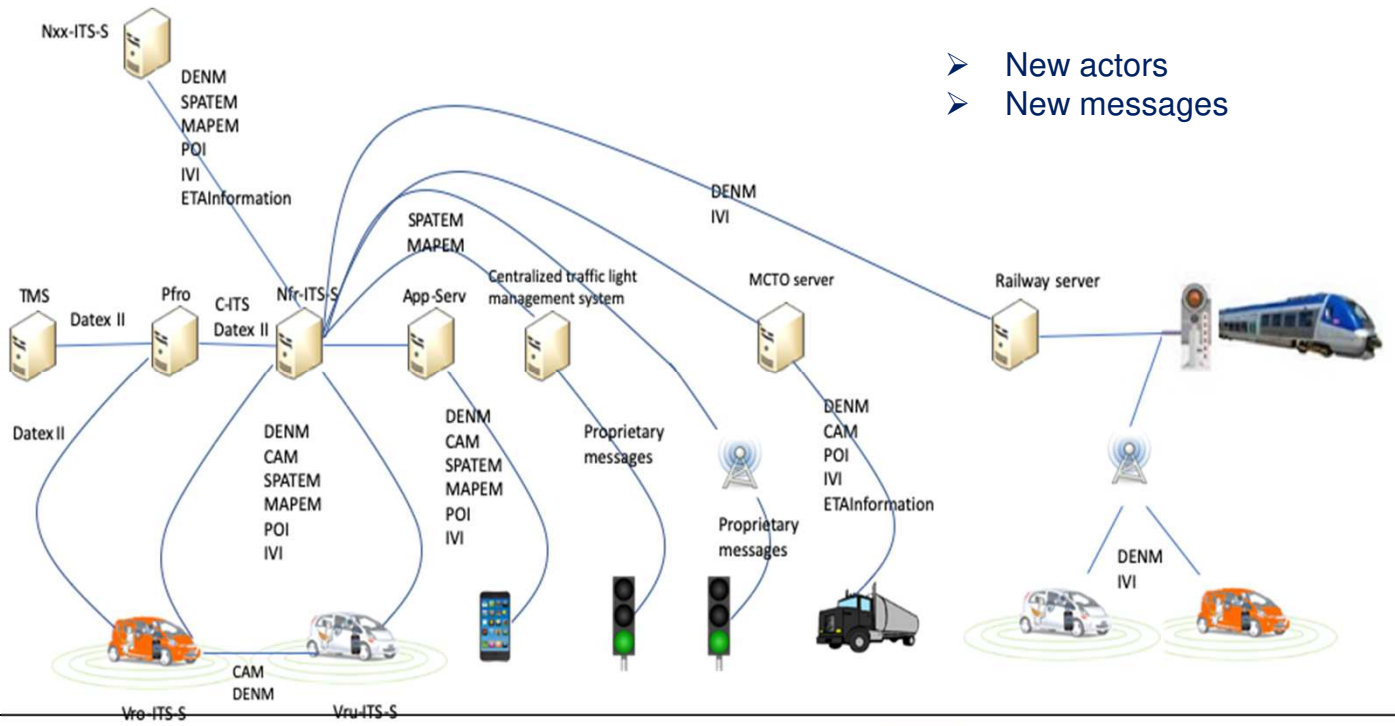
Functional architecture - principles

- New use cases
- New actors
- New technologies (cellular, Bluetooth)

- C-ITS messages are the same on long range communications as on short range communications.
- The author of the message does not necessarily know on which interface it will be distributed.
- C-ITS messages remain signed and unchanged throughout the chain (no re-signing).
- Message security is on the geonet layer in cellular and ITS-G5
- Cross-border interoperability in Europe

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

Functional architecture

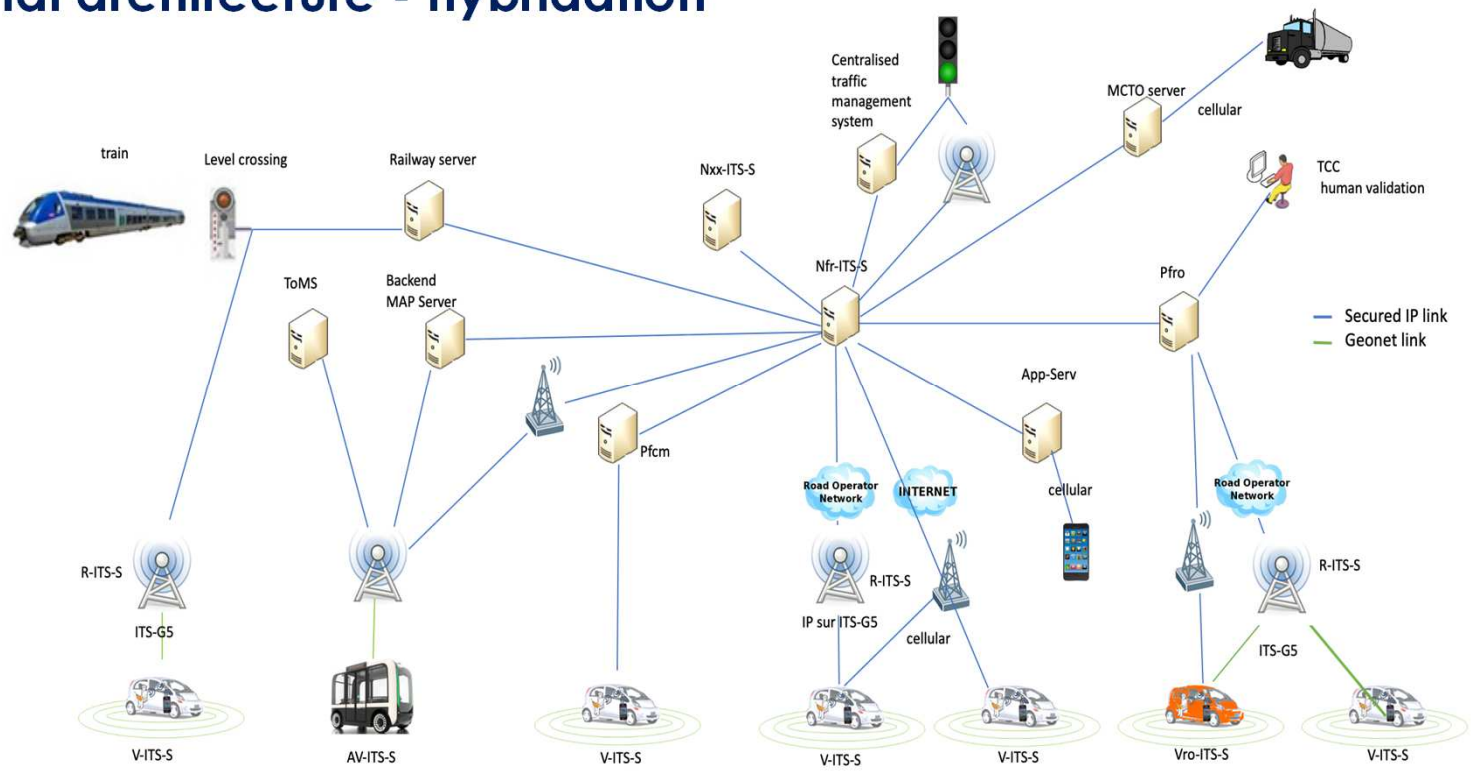


- New actors
- New messages

Component name	C-ITS-S	Not a C-ITS-S
Vru-ITS-S	X	
Vro-ITS-S	X	
R-ITS-S	X	
PFro		X
N-ITS-S	X	
No-ITS-S	X	
PFcm		X
TMS		X
APP-Serv	X	
MCTO server	X	
Centralized traffic light system (when connected to Nfr-ITS-S)	X	

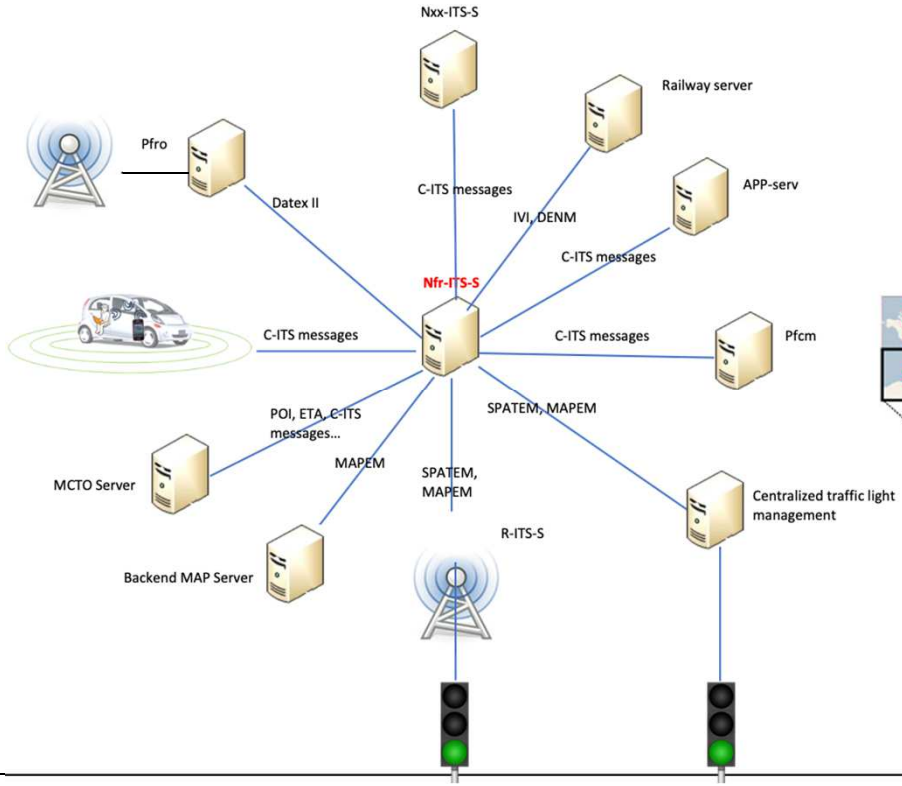
Co-financed by the Connecting Europe Facility of the European Union

Functional architecture - hybridation



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

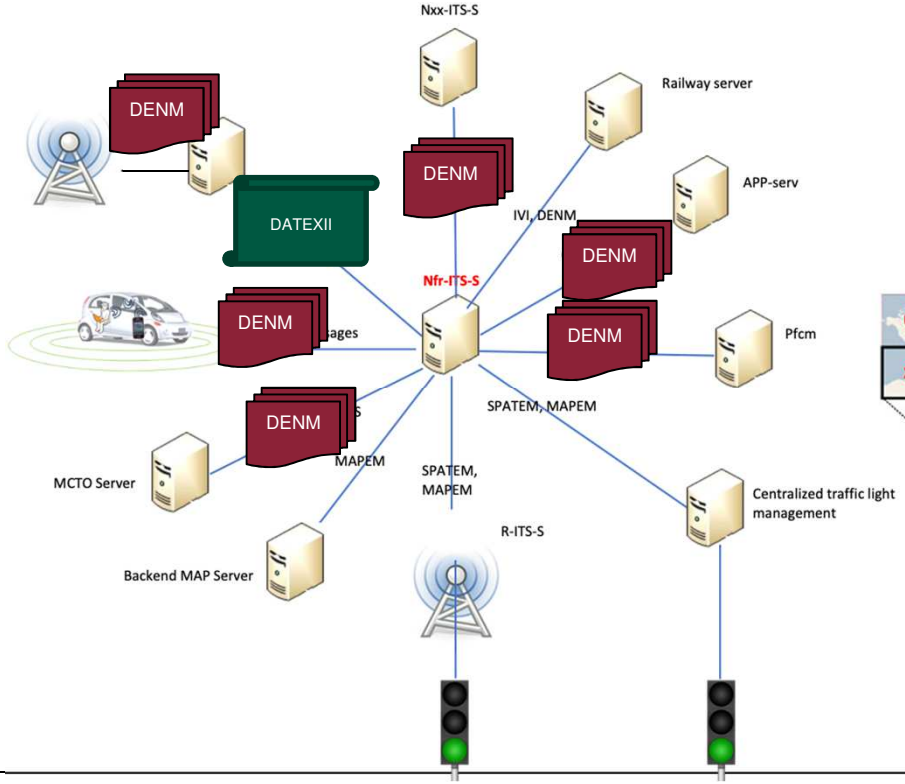
Architecture - Nfr-ITS-S : National Node



NXX -ITS-S and servers: compliant with C-Roads Platform specifications

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

Architecture - Nfr-ITS-S : National Node



NXX -ITS-S and servers: compliant with C-Roads Platform specifications

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

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

SERVICES DEVELOPED IN THE PROJECT C-ROADS FRANCE

Summary

1. Use cases from previous projects
2. Use cases deployed in C-Roads FR
3. Ambitious prospects

1.Use cases from previous projects

Use cases realized in SCOOP et pursued in C-Roads France

- Collection of V2I data
- Information on parking areas and their availability
- Hazardous location notifications
- Road works warning

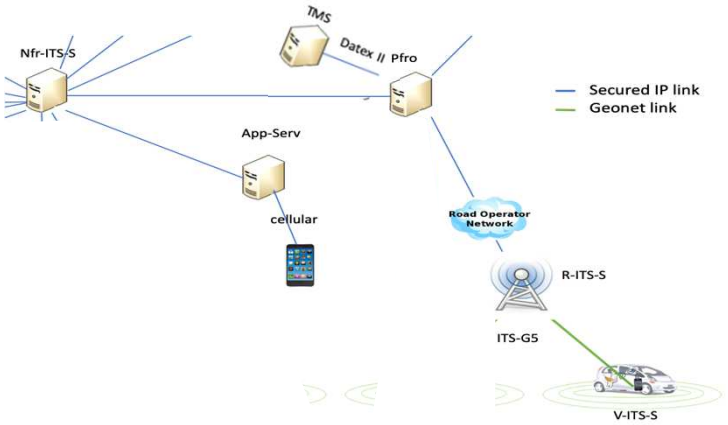
Schéma	Nom	Pictogramme	Objectifs
	Alerte chantier programmé (fixes et mobiles)	AK5	• Réduire le risque d'accidents • Informer l'usager de la route sur un risque de gêne sur la route (ralentissement, manœuvres) • Améliorer de la gestion du trafic
	Alerte d'intervention sur voies		• Réduire la prise de risque des agents d'exploitations et patrouilleurs • Réduire le risque d'accidents • Informer l'usager de la route sur un risque de gêne sur la route (ralentissement, manœuvres) • Améliorer la gestion du trafic
	Alerte véhicules prioritaires de viabilité hivernale		• Réduire le risque d'accident avec un véhicule d'intervention de viabilité hivernale • Améliorer l'efficacité des interventions

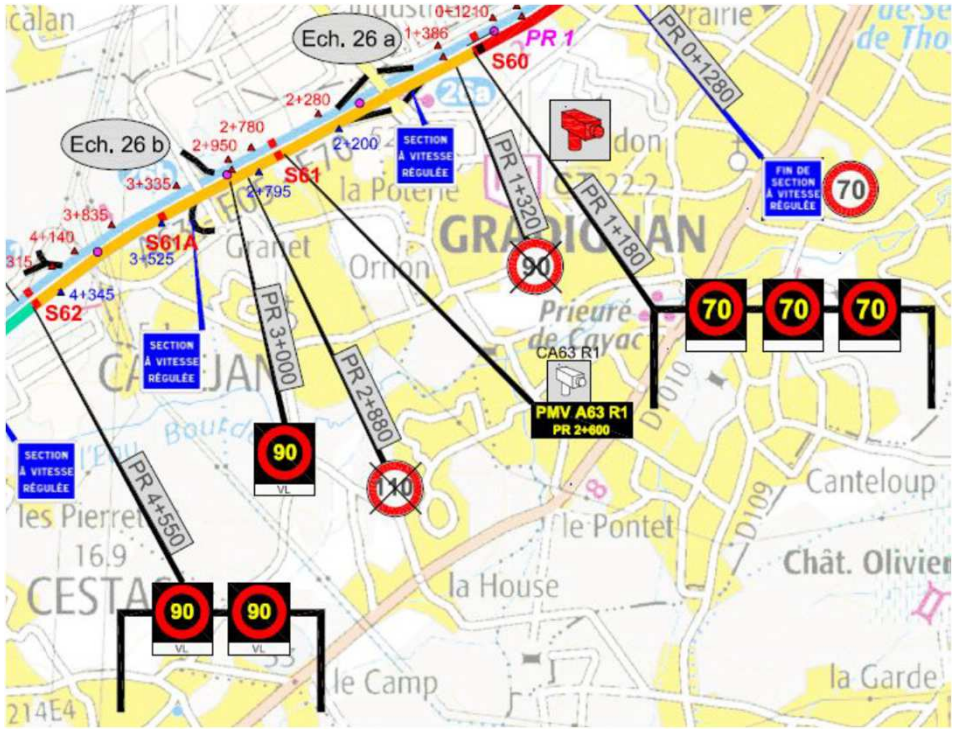
Schéma	Nom	Pictogramme	Objectifs
	Alerte route temporairement glissante		• Réduire le risque d'accidents
	Alerte animal		• Réduire le risque d'accidents • Fournir l'information le plus rapidement possible et assurer une mise à jour en temps réel
	Alerte personne sur la route		• Réduire le risque d'accidents
	Alerte obstacle sur la route		• Réduire le risque d'accidents
	Alerte véhicules arrêtés		• Réduire le risque d'accidents
	Alerte véhicules en panne		• Réduire le risque d'accidents
	Alerte zone d'accident non sécurisée		• Réduire le risque d'accidents
	Alerte visibilité réduite		• Réduire le risque d'accidents
	Alerte obstruction non gérée d'une route		• Réduire le risque d'accidents • Rediriger le trafic
	Alerte freinage d'urgence		• Réduire le risque d'accidents • Eviter des freinages en cascade qui pourraient créer un début de congestion
	Alerte queue de bouchons		• Réduire le risque d'accidents • Eventuellement, rediriger le trafic.
	Alerte conditions météorologiques exceptionnelles		• Réduire le risque d'accidents

2.Use cases deployed in C-Roads FR

In-vehicle dynamic speed limit information

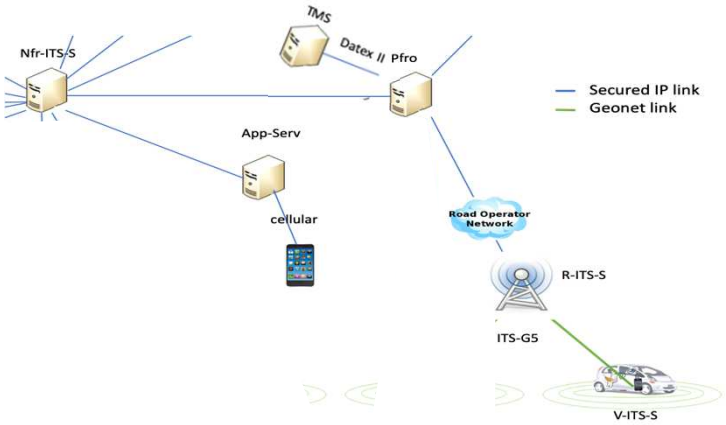
- Speed limits available on the vehicle's HMI
- Infrastructure to Vehicle (I2V)
- IVI message (in-vehicle information)



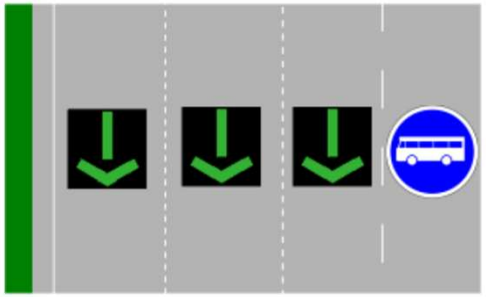


Dynamic lane management – reserved lane

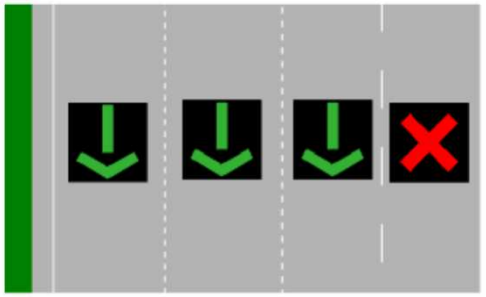
- Accessibility of the lanes displayed on the vehicle's HMI
- Infrastructure to Vehicle (I2V)
- IVI message (in-vehicle information)



Lane reserved for buses

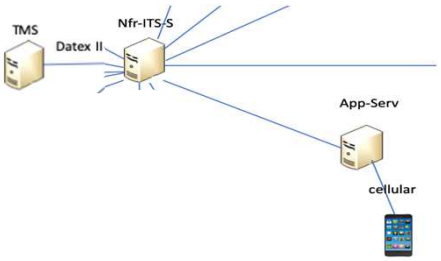


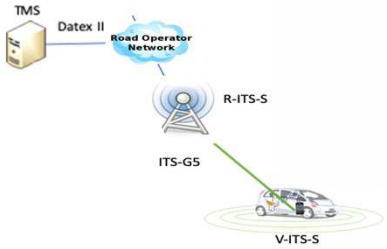
Lane not accessible

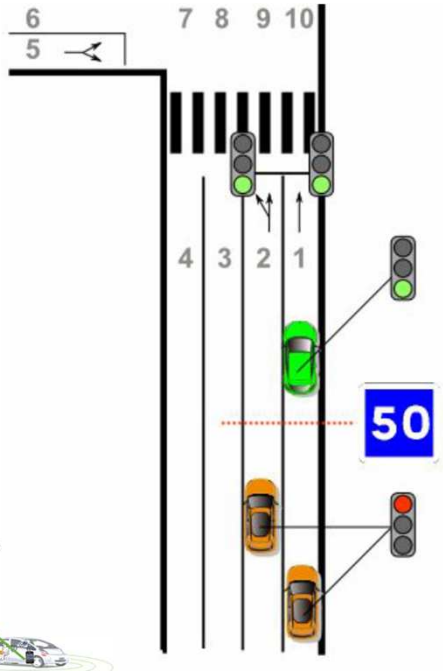


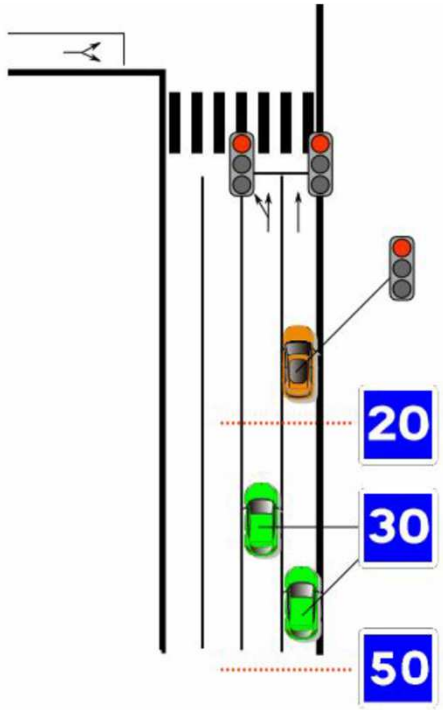
GLOSA (Green Light Optimal Speed Advisory)

- Traffic lights color of each lane while approaching an intersection & advisory speed depending on the timing
- Infrastructure to Vehicle (I2V)
- MAP (Map Extended) et SPAT (Signal Phase And Timing) messages



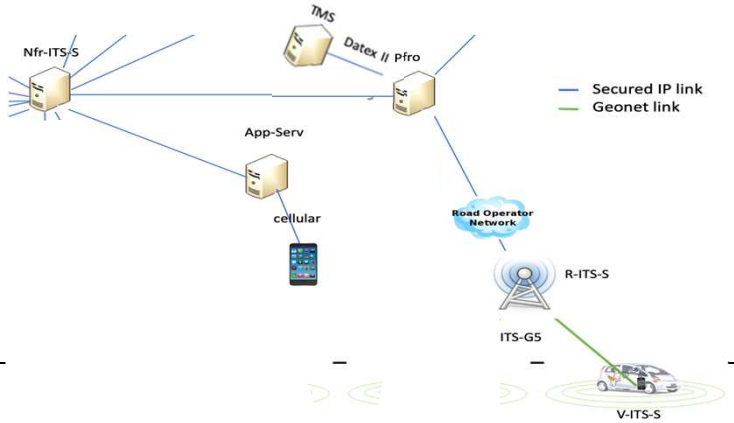




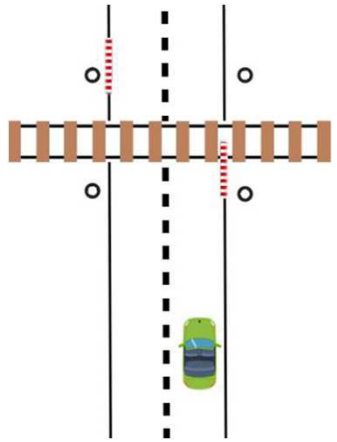


Status of the level crossing

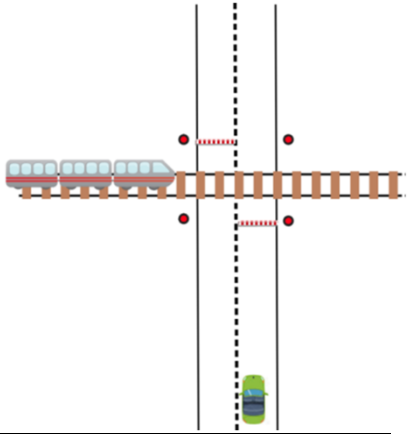
- Status of the level crossinu sent by the railway manager to the vehicle
- 3 status : nominal, closed, abnormal (dysfunctioning traffic lights, barrier opened while train approaching, etc)
- Infrastructure to Vehicle (I2V)
- DEN (Decentralized Environmental Notification) message



Status « nominal »

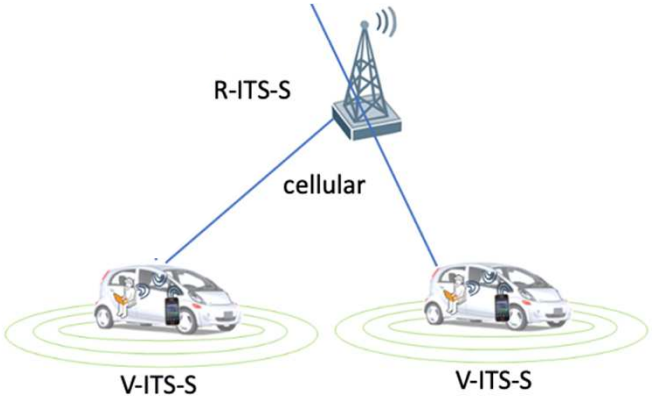


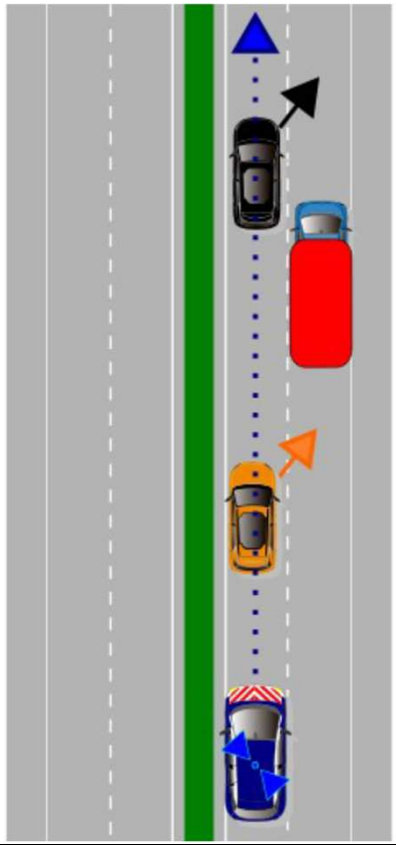
Status « closed »



Emergency vehicle approaching

- The driver inside an emergency vehicle decides to declare itself to vehicles in a close vicinity.
- Vehicle to Vehicle (V2V)
- DEN (Decentralized Environmental Notification) message





Road workers on the field

- The road worker activates his ITS station when he leaves his vehicle. The station then alerts the vehicles approaching about the position of the agent.
- Pedestrian to Vehicle (P2V)
- DEN (Decentralized Environmental Notification) message

3. Ambitious prospects

The diversification of stakeholders and use cases carries on

- Use cases allowing law enforcment agents to interact with road users.
- Adaptation of use cases to automated driving systems.
- Optimisation of toll barrier crossing.
- Detection of dangerous vehicles.
- Cartography of complex areas.
- Priority request at traffic lights.
- Communication with or in order to protect vulnerable road users.

Urban use cases => see following round table

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

BREATHER – PRESENTATION VIDEO OF COOPITS

C-ROADS
FRANCE

Co-financed by the European Union
Connecting Europe Facility

InDiD
Infrastructure Digitale de Demain

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

PANEL
« URBAN SERVICES IN C-ITS »

SYLVAIN BELLOCHE (CEREMA) – PROJECTS DIRECTOR
AUTONOMOUS AND CONNECTED VEHICLES

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

C-ROADS
FRANCE

Co-financed by the European Union
Connecting Europe Facility

InDiD
Infrastructure Digitale de Demain

Bordeaux Métropole, pilot site for CoopITS experimentation (2021)

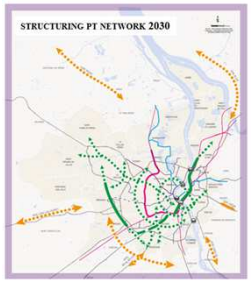


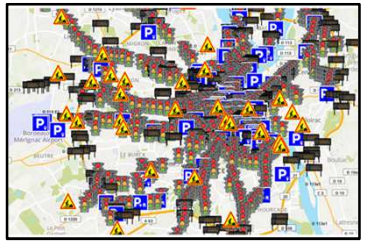


Bordeaux Metropole: partner of the **South-West pilot site** of the '**C-Roads France' project** [2016-2021] and '**C-the difference' project** [2016-2018]

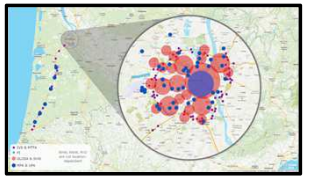
Main goals of local C-ITS deployment via **application & technology bases**:

- ✓ **Adapt the governance of connected mobility data** gradually to the scale of the urban mobility area
- ✓ Develop and deploy **a package of cooperative digital services**
- ✓ **Innovate in ecosystems** and, in particular**, integrate private mobility actors** into the design process for better management of public space
- ✓ Guarantee **a service of general common interest**
- ✓ Support the deployment and monitoring of the **metropolitan mobility plan** (e.g.: objective of a 10% reduction in automobile traffic)





CoopITS Use cases		
Use cases families	Bordeaux Métropole	
	Beltway (DIRA)	Urban roads
A- Probe Vehicle Data (PVD)	✓	✓
B- Roads Works Warning (RWW)	✓	✓
C- Signage Applications	✓	✓
D- Hazardous Location Notifications (HLN)	✓	✓
E- Traffic Information and Smart Routing	✓	✓
F- Parking, Park and Ride, Multimodality	✓	✓
G- Intersections (SI)	✗	✓
H- Traffic management	✓	✓
I- Vulnerable users	✗	✗
J- Multimodal Cargo Transport Optimization (MCTO)	✗	✗
K- Connected Level Crossing	✗	✗
L- Law Enforcement	✗	✗



✓ Service on run and integrated within the App
✓ Implemented but no data provided by infrastructure
✗ Unavailable

Eurométropole de Strasbourg: Innovation for a greener mobility

C-ITS: an opportunity for urban policies

Traffic conditions

- Support the implementation of high-occupancy vehicle lanes (2+) on M35 (ex-A35)
- Inform about heavy goods traffic restrictions in transit in urban areas
- Improve the road safety of sensitive structures (tunnels, movable bridges, etc.)
- Inform on disruptive events

On-board information system

- On-board information (virtual VMS)
- Support the deployment of “school-streets”
- Location and occupancy of public parking lots and Park-and-Ride lots
- Disabled users parking slots (location and access specificities)

Greener Mobility

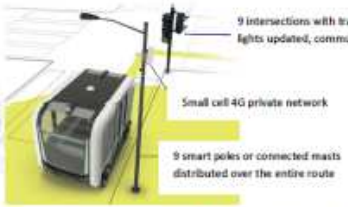
- Alert on the points of conflict between vehicles and active mobility
- Encourage carpooling from Park-and-Ride (in conjunction with Collectivité européenne d’Alsace)

C-ITS Pilot Paris

This pilot site is located in the territory of Paris Rive Gauche, in the 13th arrondissement of Paris, between the Austerlitz station, the ring road, Bercy and the Pitié Salpêtrière Hospital.
This territory presents complex mobility issues and a very dense urban environment. Through InDid, this is the first Parisian participation in a European C-ITS project.

Scope of the project in Paris

Scope of the project: an inter stations quadrilateral



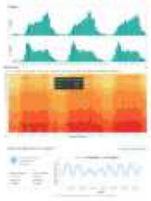
An updated urban infrastructure in service since mid-February 2021 to experiment with:

Des cas d'usage liés aux modes connectés pour la gestion des flux sur l'espace public

Improve user journeys (C-ITS shutter)
G group: signalized intersections:

- Signal Phase and Timing Information (SI-SPTI) [WG2 TF2 Release 1.6]
- G1: Green Light Optimal Speed Advisory (SI-GLOSA) [WG2 TF2 Release 1.6]
- G2: Traffic signal priority request by designated vehicles.
- 2 smartphone applications of help driving

Premiers observatoires et alertes



Provide new urban services (smart city shutter)

- guidance of visually impaired,
- electromagnetic wave observatory,
- bus channel monitoring,
- traffic counts and characterizations by sound level ...

Des solutions innovantes de mobilité et logistique

Offer autonomous services (VA shutter)

collective transport, logistics (autonomous vehicles shutter)

On the last third time of the InDid project (mid 2022-2023) we influence our partners to specify use cases that concern pedestrians and we will study the possibility to work on next use cases:

- I4 use case - Pedestrian out of intersections and out of pedestrian crossings: warning to vehicles
- A digital pedestrian call: smartphone application to generate pedestrian crossing calls (school groups, disabled people, etc.)
- A Pedestrian priority: pedestrian detection in crossing situation and adaptation of light cycles

To experiment and demonstrate that a modernized urban infrastructure (traffic lights, street lights) can respond to a variety of new urban uses and offer new services.
To validate the construction of a model of public-private partnership, and open it to other partners, making it possible to mutualize the financing of the upgrade of the urban infrastructure
To experiment with different solutions and to be able to contribute to the standardization of C-ITS technologies.

Métropole Aix-Marseille-Provence: Innovation for sustainable mobility

C-ITS: an opportunity for public transport:

Interoperable intersection priority system

- Do not depend on the technology of a manufacturer
- Rely on a system that offers many other use cases
- Be open-minded to other kinds of vehicles, such as emergency vehicles

Transmission of information on the availability of park and ride facilities (P+R)

- Incentive for modal shift
- Interoperable system: all car drivers can receive information
- Possibility to add information on the next departures of public transport

C-ITS: Prefiguring automated vehicles

- **reduces unnecessary travels** finding a parking space
- **optimizes vehicle transport:** carpooling – shared system
- **optimized travel solution** especially at the fringes of the public transport network

City of Aix-en-Provence: Innovation for users' safety

C-ITS: an opportunity for all users

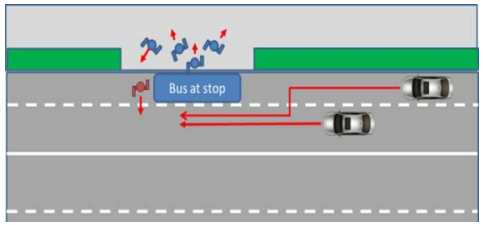
Intersection priority system

- Provide technical support for the deployment of the traffic light priority system

City of Aix-en-Provence is a member of the Metropole Aix-Marseille Provence. The City has retained its competence in « roads and road accessories ». The City of Aix-en-Provence and the Metropole Aix-Marseille Provence therefore work together, particularly on mobility issues.

Secure vulnerable road users

- Warn drivers that pedestrians hidden by a bus are crossing the street
- Limit information to make it more reliable
- Dynamic road signs



Help motorists to drive more ecologically

- Inform motorist for the better speed to adapt so as to reach the next crossroads at the green light (GLOSA)
- Limit pollutant emissions from accelerations and brakings
- Improve traffic flow by reducing the « accordion effect » due to accelerations and brakings

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

IMPACTS STUDIES RESULTS OF C-ROADS FRANCE PROJECT (VIDEOS)

Co-financed by the European Union
Connecting Europe Facility

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

C-ROADS FRANCE

InDiD
Infrastructure Digitale de Demain

Co-financed by the European Union
Connecting Europe Facility

C-Roads Impacts Studies

A. Freitas – Univ. Clermont Auvergne

Outline – Evaluation and impacts studies – Working groups

- **Sanitary Impacts : Electromagnetic field exposition -** *Divitha Seetharamdoo (Univ. Gustave Eiffel)*
- **Functional and technical evaluation -** *Hasnaâ Aniss (Univ. Gustave Eiffel)*
- **Distraction – Behavior - Road Safety -** *Laura Bigi (LAB) - V. Taillandier (SNCF) - L. Désiré (Cerema)*
- **Acceptance and Organizational impacts -** *Stéphanie Bordel (Cerema) – Mehdi Chahir (Univ. Rennes II)*
- **Traffic Efficiency and Environnement -** *Pierre Antoine Laharotte (Univ. Gustave Eiffel)*

- **Social and Economics Impacts -** *Antoine Lohou (Ministry – Transport Dept.)*
- **Legal - Regulatory impacts** - *Émilie Petit (Ministry – Transport Dept.) Antonio Freitas (UCA)*
- **Scientific et technological watch** - *Antonio Freitas (Univ. Clermont-Auvergne)*





Co-financed by the European Union
Connecting Europe Facility

Social and economic impacts and business model (WG 2.3.6)

Antoine Lohou *(Ministry – Transport dept.)*

« Social and economic impact studies (effects on road safety, environment, energy consumption, mobility...) consolidated by a benefit-cost analysis of C-ITS services»

Deliverables

C-Roads_2.3.6.1 – Social an economic Impacts : Methodology (A. Lohou)
C-Roads_2.3.6.2 – Social an economic Impacts : Results (A. Lohou)

C-Roads_2.3.6.3 – Business model – Methodology (Christophe Larue - Renault)
C-Roads_2.3.6.4 – Business model – Results (Christophe Larue - Renault)

Cas d'usage	Sigle	Réseau routier national (RRN)	Réseau départemental	Métropoles
Emergency electronic brake light	EBL	-2,7%	-2,7%	-2,7%
Emergency vehicle approaching	EVA	-0,8%	-0,8%	-0,8%
Hazardous location notification	HLN	-5,2%	-5,3%	-1,7%
Slow or stationnary vehicle	SSV	-1,1%	-1,1%	-1,1%
Traffic jam ahead warning	TJW	-2,4%	-2,0%	-1,2%
In-vehicle signage	VSGN	-1,0%	-1,3%	-1,3%
Road works warning	RWW	-1,9%	-1,9%	-1,9%
Weather conditions	WTC	-3,4%	-3,4%	-3,4%
Green light optimal speed advisory	GLOSA	0%	0%	-0,1%
Wrong-way driving	WWD	-0,4%	0%	0%
Shockwave Damping	SWD	-7.8%	0%	0%

Co-financed by the European Union
Connecting Europe Facility

Regulatory Impacts (WG 2.3.8)

Émilie Petit (Ministry – Transport Dept.) Antonio Freitas (Univ. Clermont-Auvergne)

«Studies of the impacts of the deployment of C-ITS services on the legal responsibilities of the actors»

Case studies on legal responsibilities for the following situations
(Lexing law office)

- Case 1: Level crossing use case : Road Side Unit (RSU) failure - fatal accident
- Case 2: Accident not reported by safety staff or traffic management center
- Case 3: Contradictory road signs: Variable Message Signage (VMS) / C-ITS
- Case 4: Non-intervention of a road operator patrol: over-accident

Lawsuit Simulation: speeding fine
Case 3: conflicting messages VMS – C-ITS

Co-financed by the European Union
Connecting Europe Facility

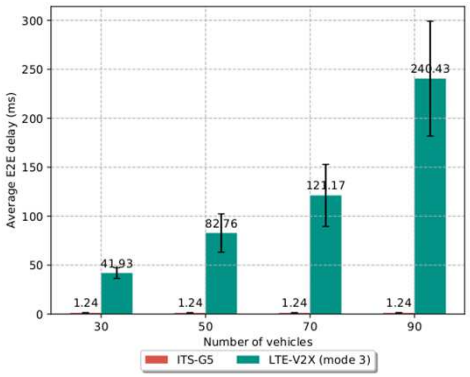
Scientific and technological watch (WG 2.3.11)

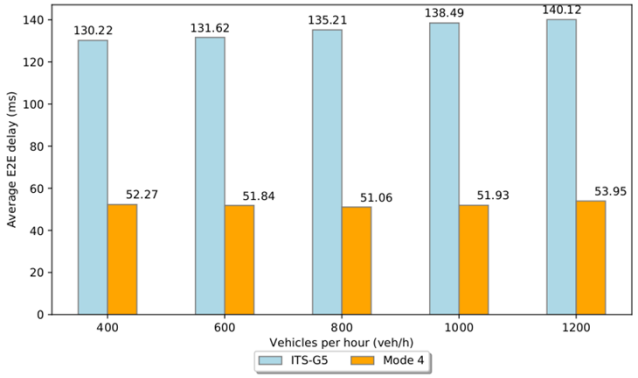
Antonio Freitas (Univ. Clermont Auvergne)

« The aim is to maintain the state of the art in C-ITS research followed by performances analysis using simulation tools to assess the scaling up of vehicular networks, ITS-G5 and LTE-V2X »

Network performances :

ITS-G5 (IEEE 802.11p)
LTE-V2X – mode 3 (in-coverage)
LTE-V2X – mode 4
(out-of-coverage using LTE-PC5)





Deliverables :

2.3.11.1 – C-Roads - Overview about heterogeneous vehicular communications
2.3.11.2 – C-Roads - Performance evaluation of vehicular communication technologies

Co-financed by the European Union
Connecting Europe Facility

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Co-financed by the European Union
Connecting Europe Facility

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

TECHNICAL EVALUATION OF COOPITS APPLICATION

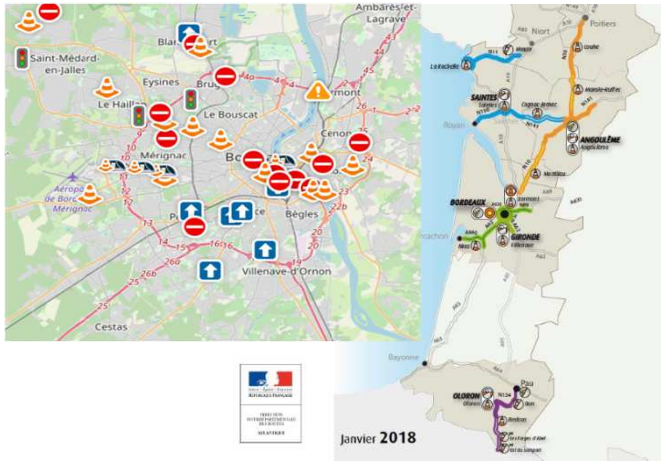
C-ROADS FRANCE

Hasnaâ Aniss – Université Gustave Eiffel

InDiD
Infrastructure Digitale de Demain

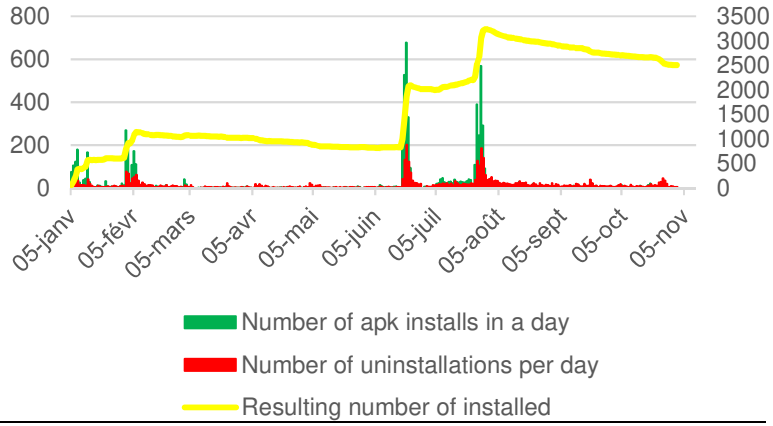
Methodology

DIRA Network + Bordeaux - City



Log of all messages sent or received by smartphones

Log of all information processed and transmitted to smartphone's HMI



Collection time: from January 1, 2021 to October 30, 2021

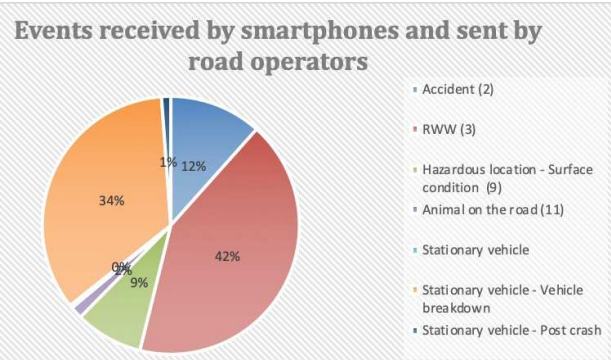
More than 3000 downloads of the application over the period

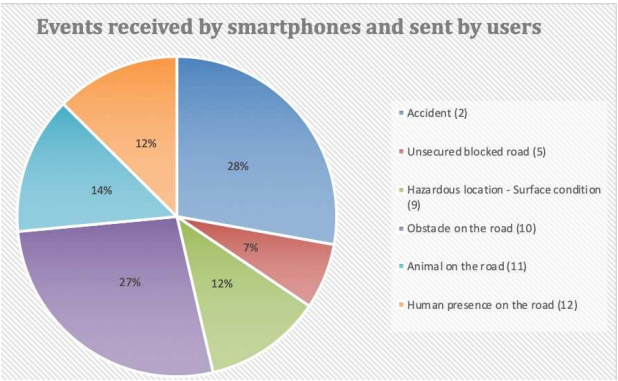
Network traffic generated by C-ITS exchanges

Message	Global volume of messages	Packet size (byte) / message	Total packet size (MB)
CAM sent by smartphones	773116	281	217.25
DENM sent by smartphones	249	163	0.04
DENM received by smartphones	10344	163	1.69
IVI received by smartphones	254056	231	58.69
MAPEM received by smartphones	523072	281	146.98
SPATEM received by smartphones	425695	73	31.08
Total	1986532	1192	455,73

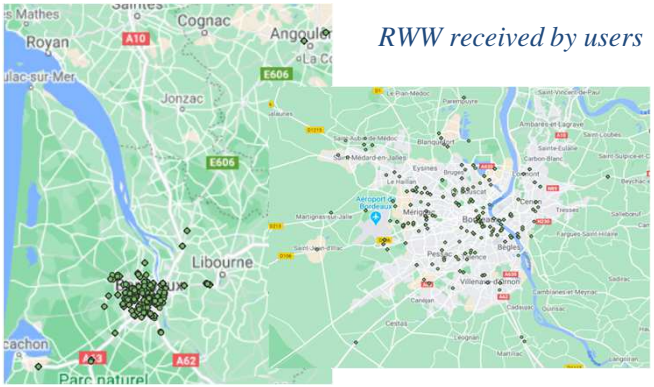
- 5497 Station IDs were active during the experimentation without any information on the number of users they represent.
- The impact on the communication network is low
- Few DENMs were sent by the application (overlay mode privileged)
- A different number of MAPEM and SPATEM

Use Cases - DENM

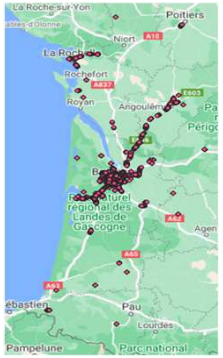




RWW received by users



Smartphone location



Events received by smartphones

Latency at the entry of a tile

	Only first receptions			
	Min (in sec)	Mean (in sec)	Max (in sec)	Std Dev (in sec)
DENM	0.001	4.319	44.904	9.402
IVI	0.001	7.555	99.972	18.217
MAP	0.001	5,148	91,869	14,856
SPAT	0.001	0.163	1.226	0.205

For IVIMs and DENMs, latency is related to the availability of information. After sending a request for a DENM or IVIM, if messages already exist, they will reach the end users within 0.1s (68.4% of DENMs)

For SPATEM, the maximum latency of 1.2 s seems too high to obtain relevant information (phase of the lights changing per second).

latency for MAPEM Messages

	%	mean	Standard deviation
latency < 0,1s	0,44	0,010	0,002
latency < 0,5s	0,66	0,014	0,663
latency < 1s	0,66	0,025	0,084
latency < 10s	0,87	0,486	1,725
latency > 10s	0,13	36,38	23,895

HMI Display

eventcausecode double precision	avg double precision	min double precision	max double precision
2	11.5918947368421	8	21.004
3	9.2991	0.994	12.995
5	1.935	1.935	1.935
9	20.0015454545455	0.722	45.995
10	[null]	[null]	[null]
11	5.39075	0.58	9.997
12	14.99775	0.992	42.007
94	9.599	2.052	13.086

Number of HLN events displayed	73
Number of VMS displayed	805
Number of glosa displayed	1662

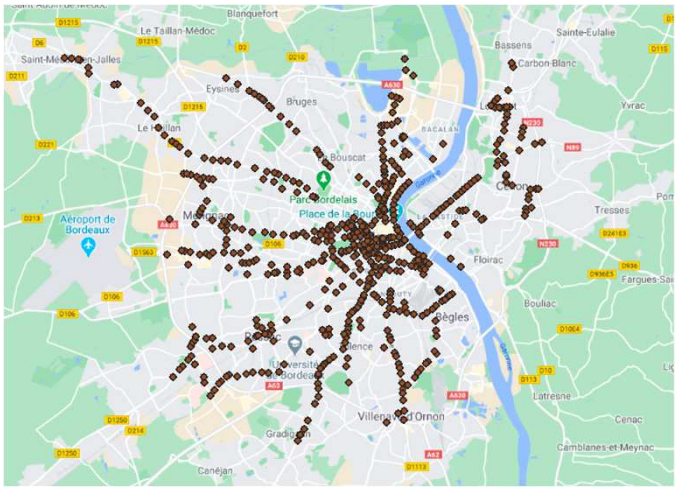
Sent by road operator

eventcausecode double precision	avg double precision	min double precision	max double precision
2	10.2004666666667	8	15.846
3	9.2991	0.994	12.995
9	20.0015454545455	0.722	45.995
11	9.993	9.989	9.997
94	9.599	2.052	13.086

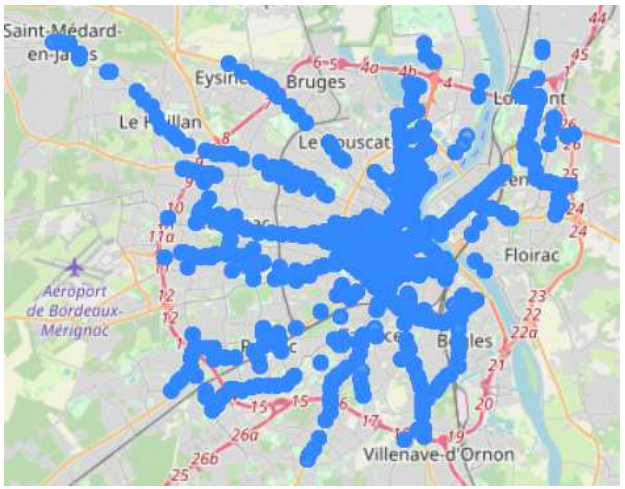
- The average display time varies between less than 1s and 20s
- Relevance of a display < 1s

Uses Cases – SPATEM/MAPEM

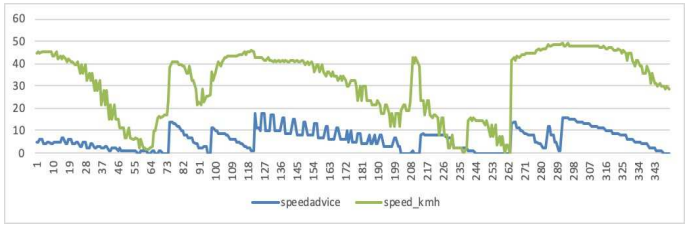
The geographical distribution of SPAT triggered by road-operators

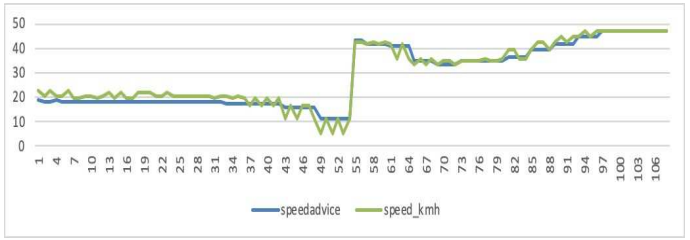


The geographical distribution of MAP triggered by road-operators

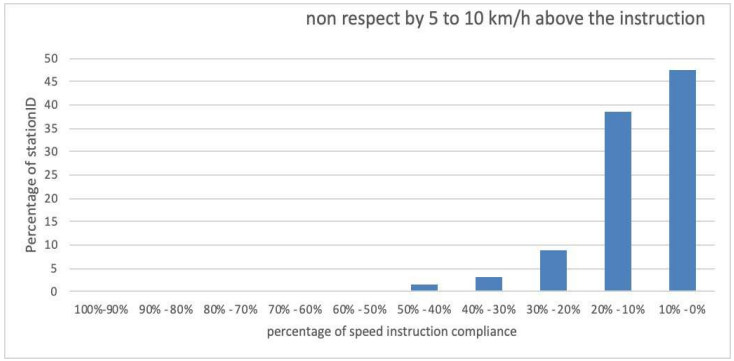


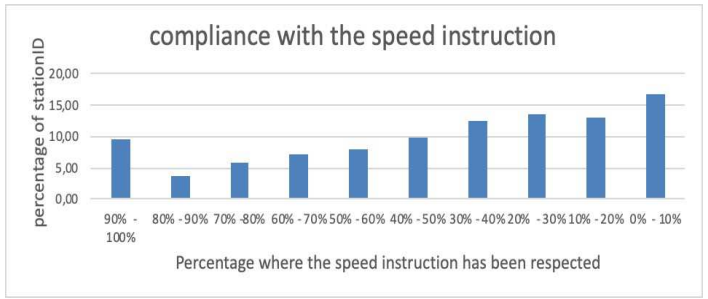
Uses Cases – SPATEM/MAPEM





When drivers follow at least one instruction, up to 10% will follow the instructions more than 90% of the time, but more than 15% will follow the speed advice less than 10% of the time.





Nearly 80% of drivers comply with less than 20% of speed instructions by going 5-10 km/h over the instruction.

Conclusion

- The messages were received and correctly displayed throughout the period.
- The RRW is the most sent DEN message by the road operators the acceptability of the system.
- The latency of the messages sometimes high (GLOSA) the acceptability of the system
- The experimentation continues on INDiD where we will have 2 years of data collected on the New Aquitaine region. The database will be enriched with data and contextual information.
- Additional analysis of the system's behavior after receiving information.
- Alternative while waiting for a massive deployment of connected vehicles and infrastructures

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Co-financed by the European Union
Connecting Europe Facility

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

C-ROADS FRANCE

COOPITS ACCEPTANCE

User acceptance for Coopits services.
Pre test methodology

S. Bordel – Cerema, Equipe PsyCAP
M. Chahir – Université Rennes 2, LP3C

InDiD
Infrastructure Digitale de Demain

Introduction

Context

- Deployment of the Coopits application in Bordeaux for a pre-test
- Available to users on January 5, 2021

Study

- Acceptance evaluation of the application by users
- Study conducted between January 5 and August 28, 2021 [8 months].

Methodology (1/3)

Protocol

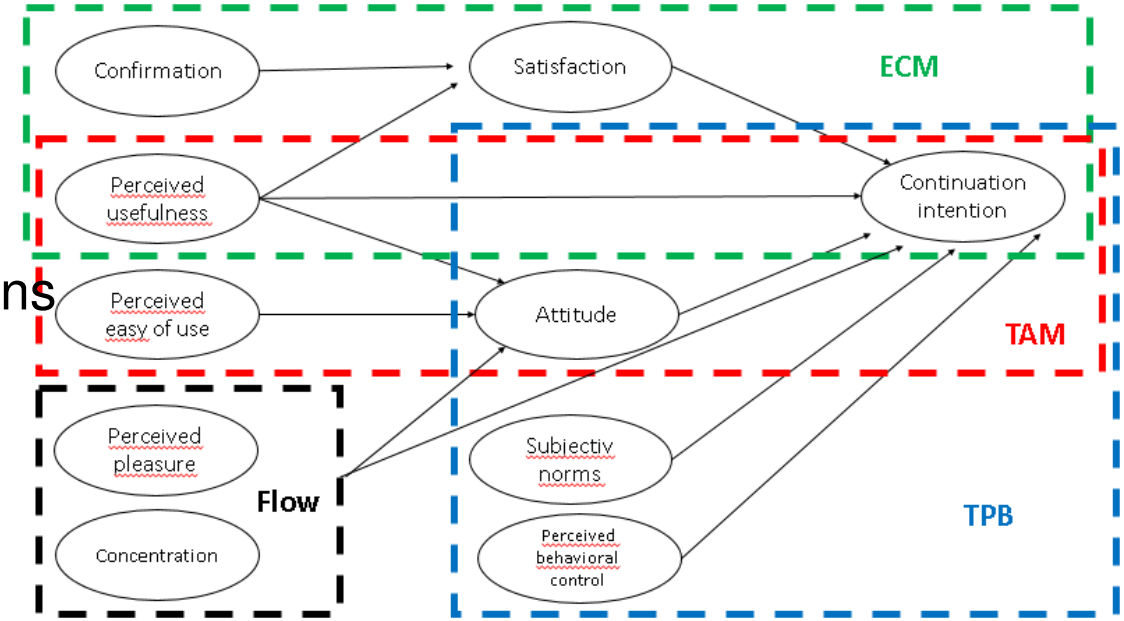
- Email address asked after the first connection to Coopits
- Distribution of an online questionnaire about 1 week after this first connection

Methodology (2/3)

Material

- Questionnaire of 86 questions in 4 parts:

1) Experience with Coopits
2) Acceptance (Lee, 2010) : 10 dimensions
3) Opinion on the application and its features
4) Participant informations



An extension of the confirmation of expectations model (Lee, 2010)

Lee, M.-C. (2010). Explaining and predicting users' continuance intention toward e-learning : An extension of the expectation–confirmation model. *Computers & Education*, *54*(2), 506-516. https://doi.org/10.1016/j.compedu.2009.09.002

Methodology (3/3)

Participants

- 3022 users solicited; 170 responses (5.6%)
- 91 who actually used Coopits (3.0%)

Âge	33.0% between 46 and 55 years old; 19.0% between 26 and 35 years old; 14.3% over 65 years old; 12.1% between 56 and 65 years old; 9.9% between 26 and 35 years old; 7.6 no answer; 3.3% between 16 and 25 years old
Genre	77 men - 9 women - 5 no answer
Permis	75.8% more than 20 years; 12.1% more than 10 years; 5.5% no answer; 4.4% more than 1 year; 1.1% less than 1 year; 1.1% more than 5 years
Habitude	96.7% of participants have already used an application of the same type as Coopits

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Projet SCOOP véhicules et routes connectés connected vehicles and roads
InterCor
C-ROADS FRANCE
InDiD Infrastructure Digitale de Demain
Co-financed by the European Union
Connecting Europe Facility

Main results (1/3) : acceptance

Dimension	α	M (ET)
Perceived usefulness	*0,66**	2,74 (1,47) ⊖
Perceived easy of use	0,86	⊕ 4,31 (1,48)
Intent to use	0,92	3,73 (1,68) =
Attitude	0,95	3,51 (1,47) =
Subjective norms	0,91	3,32 (1,38) =
Peiceived behavioral control	0,91	⊕ 4,12 (1,53)
Confirmation	0,82	2,81 (1,40) ⊖
Satisfaction	0,90	2,91 (1,53) ⊖
Pleasure	*0,70**	2,88 (1,16) ⊖
Concentration	*0,37**	2,36 (0,92) ⊖

*alpha below 0.75, items were analyzed separately.

Main results (2/3) - experience with Coopits

- **Experience**. Low experience with the tool: 82.4% have used it less than 5 times and 90.1% less than 10 times. Only 9.9% have used it more than 10 times.
- **Context**. Mostly used in urban areas (75.8%), in inter-urban areas (expressways, freeways and ring roads; 65.9%) and slightly less in rural areas (38.5%).
- **Usage mode.** Mainly used in overlay (50.5%), alternating with another application when needed (23.1%) [Waze and Google Maps in the lead], no longer uses Coopits (16.5%), or uses Coopits exclusively (4.4%).
- **Reported events.** Only 24 users (26.4%) declared to have reported events on the application (obstacle 13/24, accident 9/24, blocked road 9/24...).
- **Events received**. Only 25 users (27.5%) reported receiving information (traffic conditions or accident 16/25, roadworks 12/25, glosa 9/25, parking 8/25...).

Main results (3/3) – opinion on Coopits

- **Expectations.** Less responsive than other applications (M = 2.76, SD = 1.50).
- **Credibility.** Confidence and trustworthiness rated well (M = 5.20, SD = 1.15; M = 5.08, SD = 1.49).
- **Unreported events**. 40 users (44%) say they have not received information about events on their route. Among the main ones: events related to traffic conditions, accidents ... (30/40), roadworks (25/40) or the optimal speed to get the green light (8/40). Application better evaluated by users who received information (M = 3.7, SD = 1.37) compared to those who did not (M = 2.4, SD = 1.33)*.
- **Features Prioritization**. 1) information messages and alerts (64.8%); 2) optimal speed to get to the green light (48.4%); 3) overlay function (38.5%); 4) reporting events to road managers (31.9%); 5) navigation assistance (27.5%); 6) on-board display of PMV (20.9%); 7) location and availability of parking lots (19.8%)

*($t(86) = -4{,}10$, $p < 0{,}0001$)

Conclusion

- Application considered easy to use.
- Information transmitted is well evaluated by the users.
- Areas for improvement:
  - Provide more information through Coopits
  - Further development of Coopits, especially towards the functionalities expected by users, to make it seem more useful
- The evaluation offers some food for thought but should be considered with caution: (1) low participation in the questionnaire (91 users); (2) low experience with Coopits; (3) application in test phase.

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

DISTRACTION

ATTENTIONAL DEMANDS OF USING AN APPLICATION FOR REAL-TIME TRAFFIC INFORMATION FEEDBACK IN ROAD OPERATORS' VEHICLES

L. Désiré ; R. Gritti
Cerema, PsyCAP Team

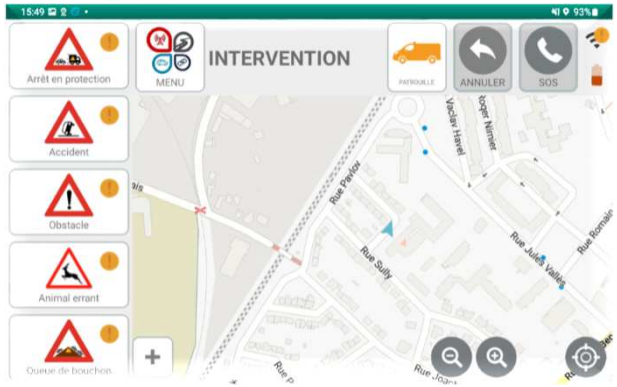
Introduction

Context

- Deployment of an an application in road operators'vehicles for real-time feedback of road traffic informations -> alerting road users in real time
- Distraction issue raised by study of *a priori* acceptability among french road operators agencies (SCOOP project; Chahir et al., 2019)

Study objective

- Evaluate attentional demand among french road operators during interaction tasks with the traffic reporting application (*SCOOP application*)



Chahir, M., Bordel, S., & Somat, A. (2019). Étude d'impact organisationnel chez les gestionnaires routiers—Rapport final de l'action de recherche—Accompagnement des évolutions organisationnelles et humaines introduites par la conception et le déploiement d'une innovation technologique (C-ITS) par l'analyse du système humain-technologie-organisation (Livrable du projet SCOOP 2.3.5.3; p. 94).

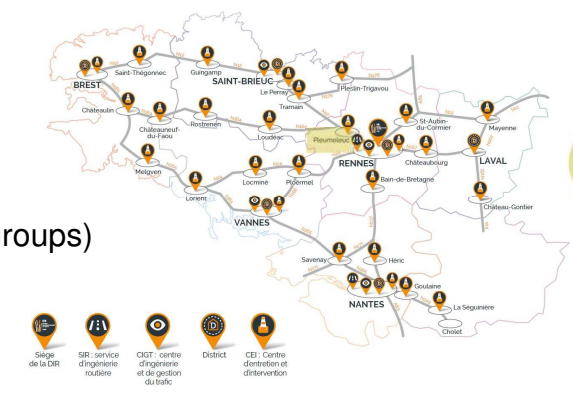
Methodology (1/3)

Study's principle:

- in-vehicle systems assessment methodologies (Strayer et al., 2019)
- Instrumented vehicle on an open road

Participants

- One of the French road operators agency's employees (DIR Ouest)
- 20 participants recruited into (3 differents professionals' groups)
  -> 18 participants realised the whole experiment

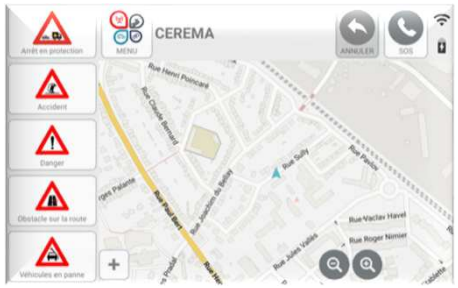


Strayer, D. L., Cooper, J. M., Goethe, R. M., McCarty, M. M., Getty, D. J., & Biondi, F. (2019). Assessing the visual and cognitive demands of in-vehicle information systems. *Cognitive Research: Principles and Implications*, *4*(1), 18. https://doi.org/10/gf7kgd

Methodology (2/3)

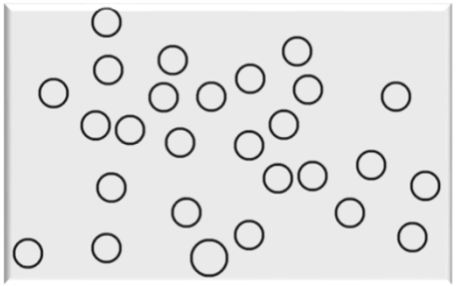
Comparison of the attentional demand of different secondary tasks

- **SCOOP application tasks**
  - Screen 1 : 1 press
  - Screen 2 - Top : 2 presses
  - Screen 2 – Bottom : 1 press, crolling plus 1 press



- **Radio task** : « acceptable » task

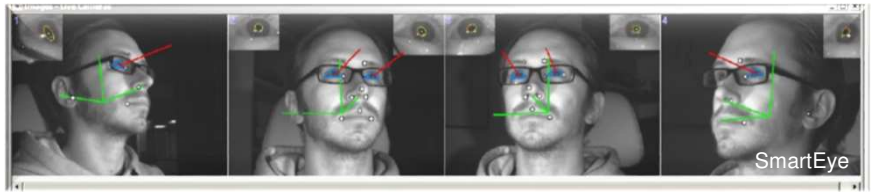
- **High demands « artificials » tasks**
  - High visual demand (Surrogate reference task)



  - High cognitive demand (2-back task)

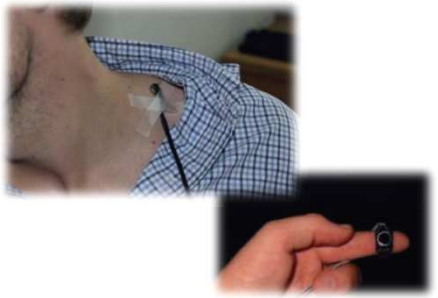
Stimulus	5	3	7	0	2	…
Response	silence	silence	5	3	7	…

Methodology (3/3)



Calculation of 4 standardised scores

- **Subjective demand**: perceived mental workload (Reimer et al., 2013)
- **Task duration**: time to complete the task (The Observer, Noldus IT, The Netherlands)
- **Visual demand**: % of time spent with eyes on the road (eye-tracker, SmartEye, Sweden)
- **Cognitive demand**: reaction time to a tactile stimulus (Red Scientific, USA)



Statistical analysis :

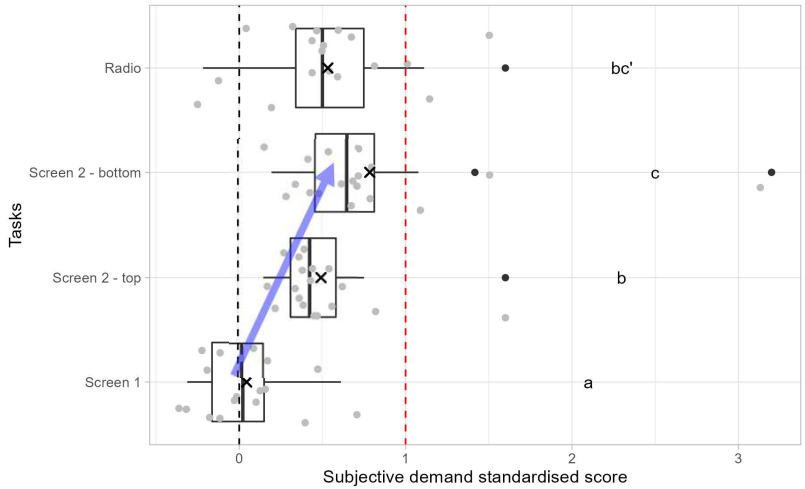
- Comparison of different mixed effect models (Task Type ; Group ; Task Type x Group)
- Model kept : Task Type effect (Screen 1, Screen 2 – top, Screen 2 – bottom, Radio)

Reimer, B., Mehler, B., Dobres, J., & Coughlin, J. F. (2013). The effects of a production level « voice-command » interface on driver behavior : Reported workload, physiology, visual attention, and driving performance (MIT AgeLabTechnical Report N° 2013-17A). Massachusetts Institute of Technology.

Results (1/2)

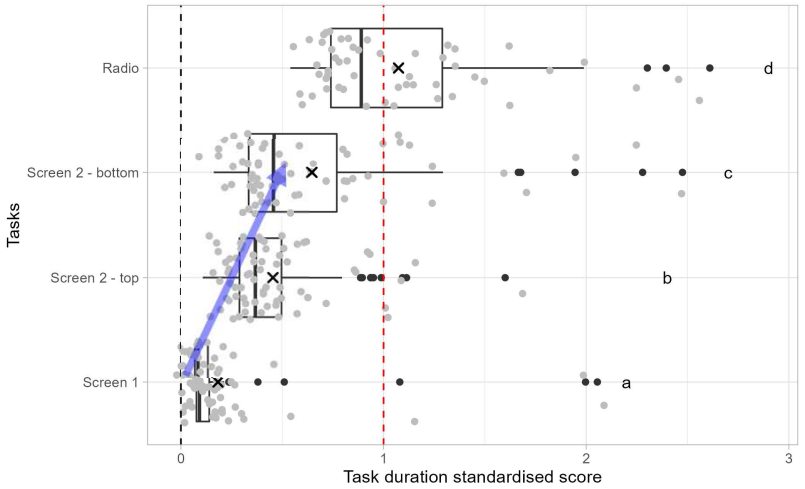
Subjective demand

(Task type : F(3, 51) = 17.30, p < 0.001)



Task duration

(Task type : F(3, 241.25) = 70.74, p < 0.001)



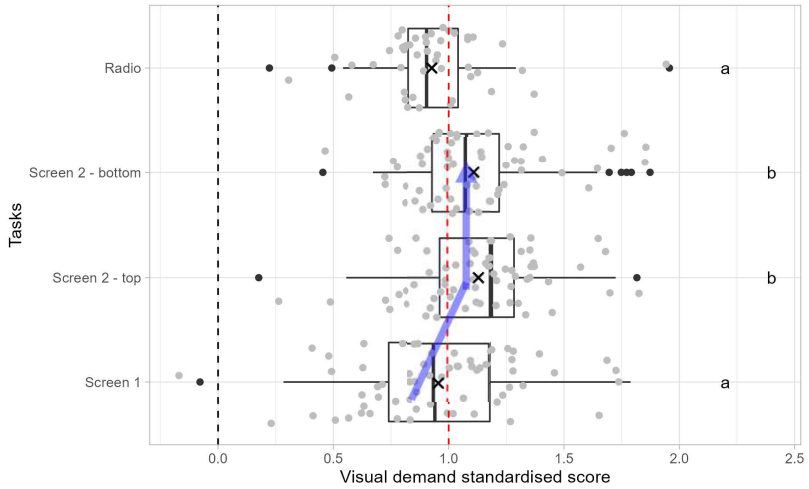
↗ subjective demand & task duration with complexity of the interaction with the application

… but under the levels for high demands

Results (2/2)

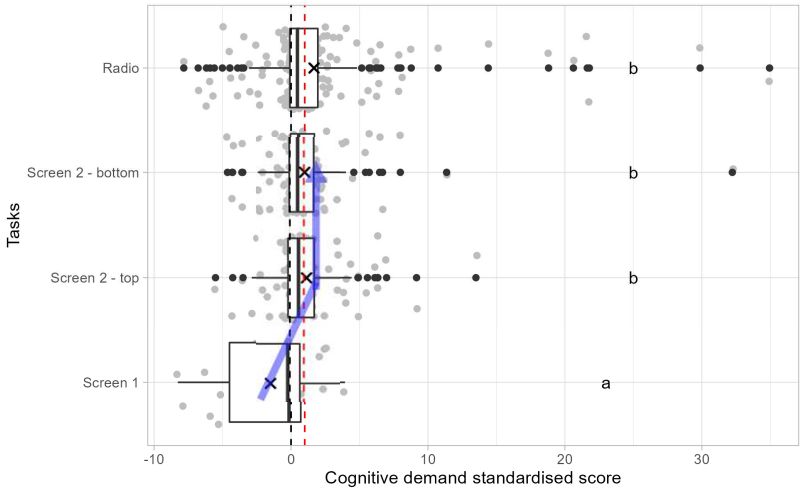
Visual demand

(Task type : F(3, 213.79) = 9.55, p < 0.001)



Cognitive demand

(Task type : F(3, 372.55) = 8.93, p < 0.001)



Visual & cognitive demands higher for any interactions with the 2nd screen of the application … and above the levels for high demands

Conclusion

Opportunity for road operators' vehicles to alert road users using a application for real-time traffic information feedback without causing distraction:

- possible from the 1st screen
- would be an issue from the 2nd screen

… different conceivable improvements to reduce attentional demands

- Road operators training : improve application knowledge ;
- Change the interface : Items' presentation on the 2nd screen, font size, contrast

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

WEBINAR

Final event C-ROADS – France

Electromagnetic field exposure assessment

Divitha SEETHARAMDOO, Narimane Awada MISLMANI, and Christophe ROSINSKI
(COSYS/LEOST - Université Gustave Eiffel)

Context

- **Usecase: Roadworkers equiped with an 802.11p system**
  - Assessment of occupational exposure of roadworkers in the field – with an 802.11p bodyworn system

Regulatory Framework

Objective

- Definition of guidelines and requirements for limiting exposure to time-varying electric, magnetic and electromagnetic fields

European council recommendation 1999/519/EC on limitation of exposure of the general public to electromagnetic waves

- Based on the recommendations of ICNIRP (International commission on non- ionizing radiation protection)
- Recommendation transposed in France - Decree 2002-77

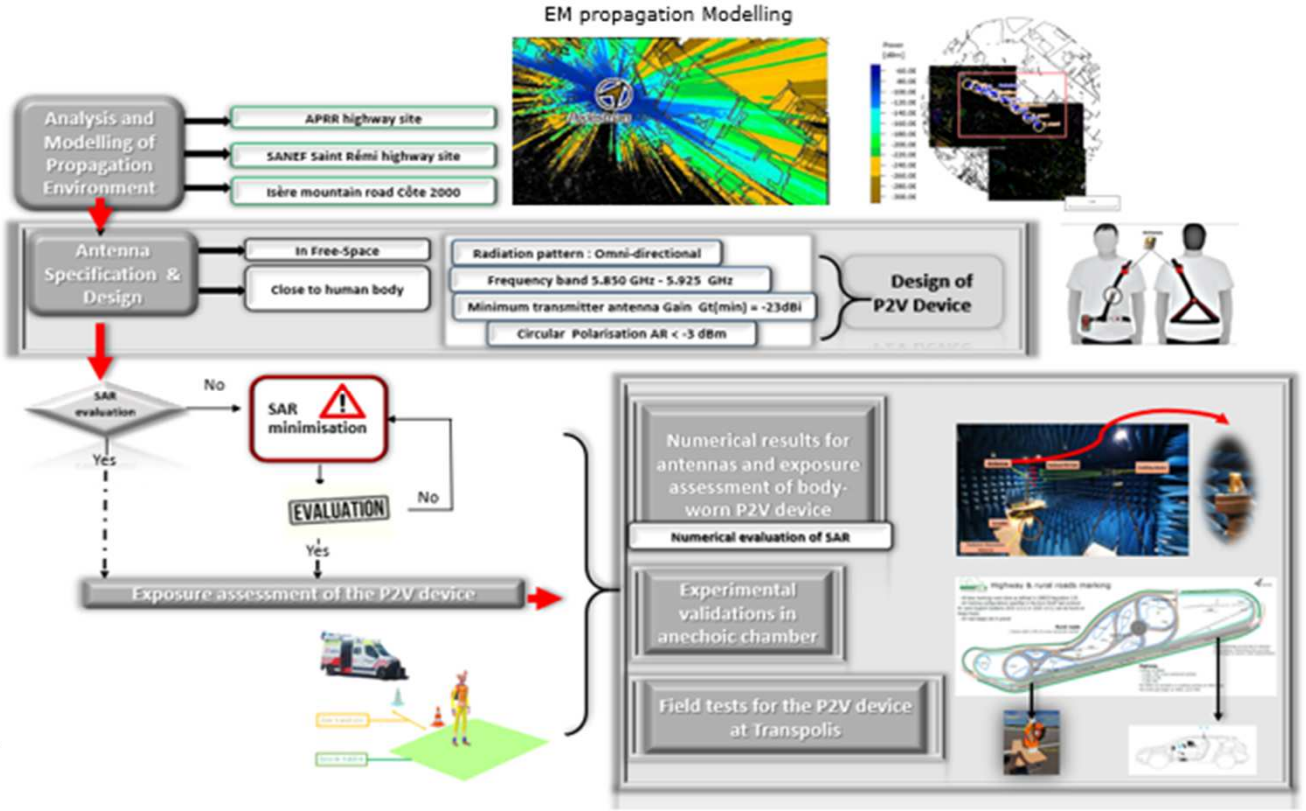
European council directive 2013/35/EC on the minimum health and safety requirements regarding exposure of workers to risks arising from electromagnetic fields

- Recommendation transposed in France by Decree 2016-1074

IEEE/IEC 62704-1-2017(standard)

- Numerical method for Determining the Peak Spatial Average Specific Absorption Rate (SAR) in the Human Body from Wireless Communications Devices, 30 MHz - 6 GHz.

EM exposure management “by design” methodology



P2V 802.11p system specifications

Objective of the P2V system

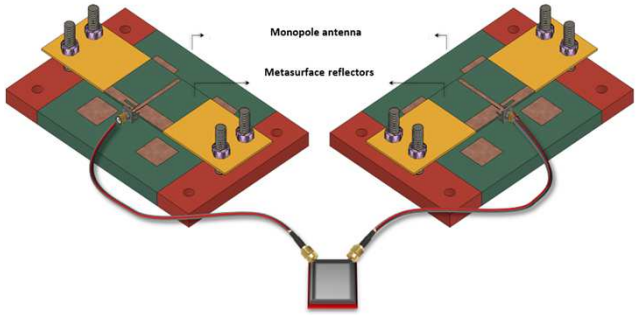
- Provides safety service to road workers on the highway environment

Requirements

- The minimum broadcast distance of the device must be 300 m to be effective even in adverse weather conditions on the highway (taking into account the reaction time at a speed of 130 km/h)

Antenna system specifications

- Consideration of minimum broadcast distance requirements for gain, efficiency, etc…



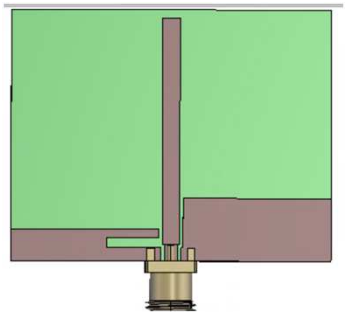
P2V antenna system

- Radiation pattern : Omni-directional
- Circular Polarisation AR < -3 dBm
- Frequency band 5.850 GHz - 5.925 GHz
- Minimum transmitter antenna Gain = -23dBi

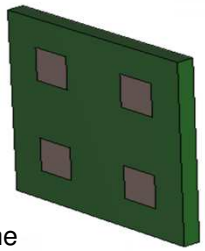
SAR limit values for the occupational exposure

Exposure Limit Value ELVs related to whole-body heat stress expressed as averaged SAR (Specific Absorption Rate) in the body: 0.4 Wkg−1

Antenna Design

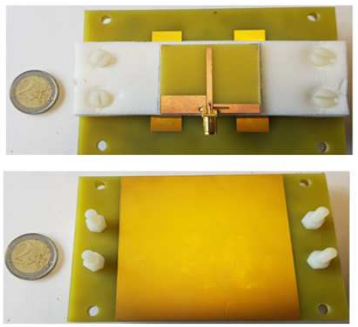


Metasurface of reflection coefficient with 0° phase



Metasurface to minimize the human body exposure to EM fields (SAR)

Prototype

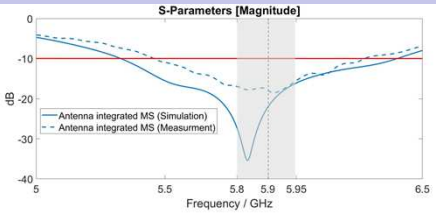


P2V device integrated

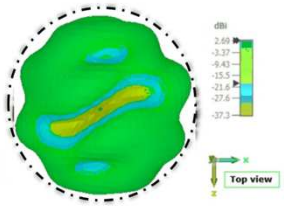
Results of P2V system designed and tested

Antenna performance

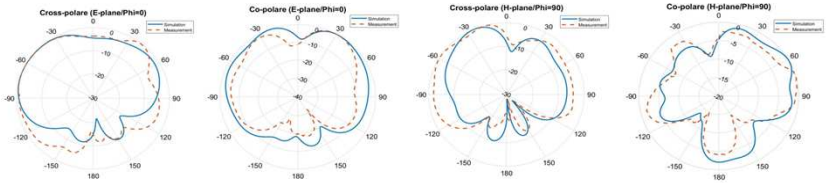
Simulated Return Loss, validated by measurement with S_{11} < -10 dB



3D radiation Pattern of the antennas back to back omni-directional



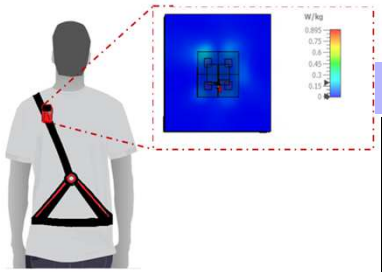
Simulation results are in good agreement with experimental measurements in E-plane and H-plane at 5.9 GHz.



Exposure results and field tests

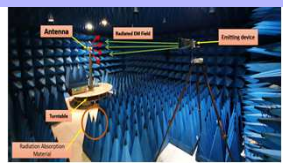
Specific Absorption Rate (SAR)< 0.4 W/kg

The maximum SAR value 0.193 W/kg shows that it is well within the limits of the safety standards of the ICNIRP and FCC.

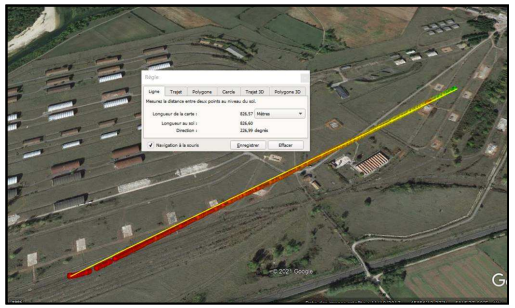


Transpolis

Anéchoic chamber



- APRR C-ITS equipped vehicles
- **Maximum reception distance reached of 860 m**
- Initial specification of 300 m



Conclusion

- **EM exposure assessment for the usecase : Roadworkers in the field**
  - IEEE 802.11p body-worn communication systems

- **Evaluation methodology “by design” in several steps**
  - Electromagnetic modelling with pilot site consideration
  - Specify the antenna system for the communication device
  - Antenna system design, fabrication and performance evaluation
  - Evaluation of the exposure due to the communication system integrating the antenna

- **Twofold evaluation**
  - Functional

  Matching of the antenna in the ITS band, Omnidirectional radiation pattern and good agreement between modelling and experimentation
  - Exposure to waves

  Specific absorption rate (SAR) = 0.193 W/kg (Threshold SAR for bodyworn device close to trunk : 0.4 W/kg)
- **Next steps**

  From Proof Of Concept (POC) to a miniaturised P2V system with a higher level of integration.

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

WEBINAR

C-ROADS Final Event – France

Impact Evaluation On Traffic Efficiency in France

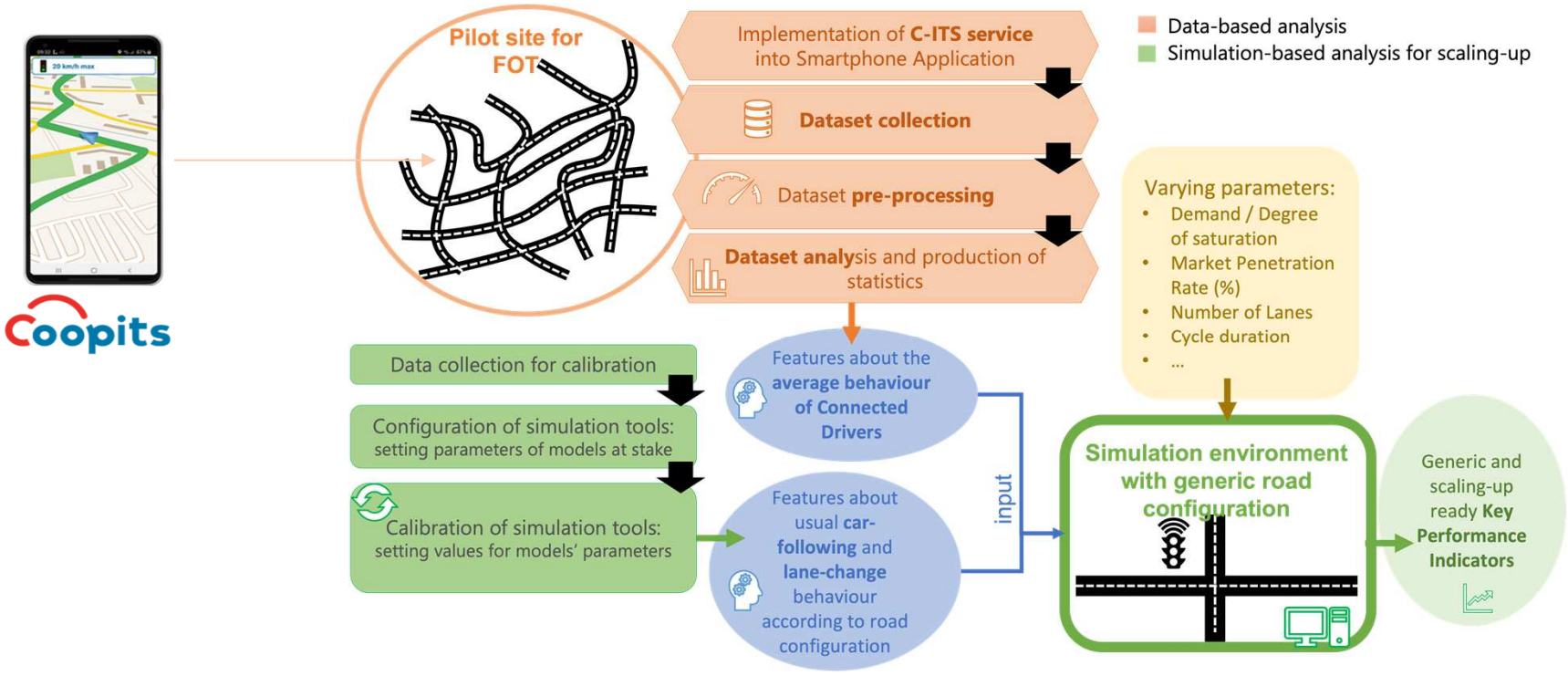
Speaker: P.-A. Laharotte (LICIT-ECO7 - Université Gustave Eiffel/ENTPE)

Purpose of the Workig Group

+ Evaluation of the impact of use cases in terms of
  + **Traffic Efficiency**
    + Example of Key Performance Indicators
      + Total Travel Time / Number of Stops / Standard Deviation of speed
  + **Pollutant Emissions**
    + Example of Key Performance Indicators
      + CO_2 / NOx / Fuel Consumption

+ Focus on 2 use cases
  + **IVS-DSLI**:
    + Broadcast a Dynamic Speed Limit instruction to connected drivers
  + **SI-GLOSA**: Green Light Optimal Speed Advisory
    + Broadcast a speed advisory in the vicinity of connected traffic lights in order to reduce the number of stops at the intersection

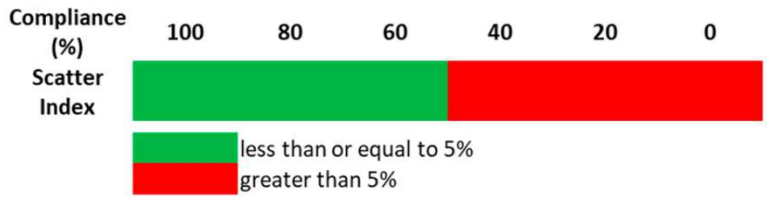
Implemented methodology

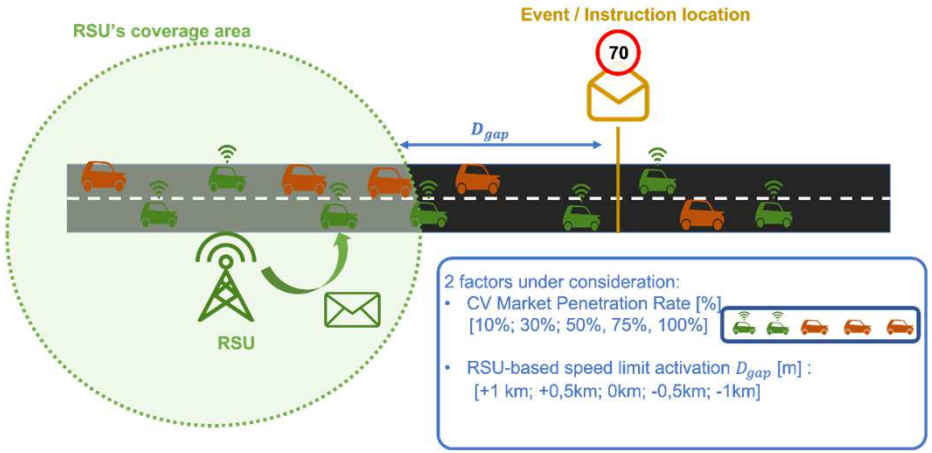


Main findings about DSL

+ The **FOT reference** is performed on Highway A63 (Bordeaux) with Variable Message Signs
    + The **digital twin** (simulation-based) highlights that the drivers'response rate for VMS is in the range [60%; 100%] ;

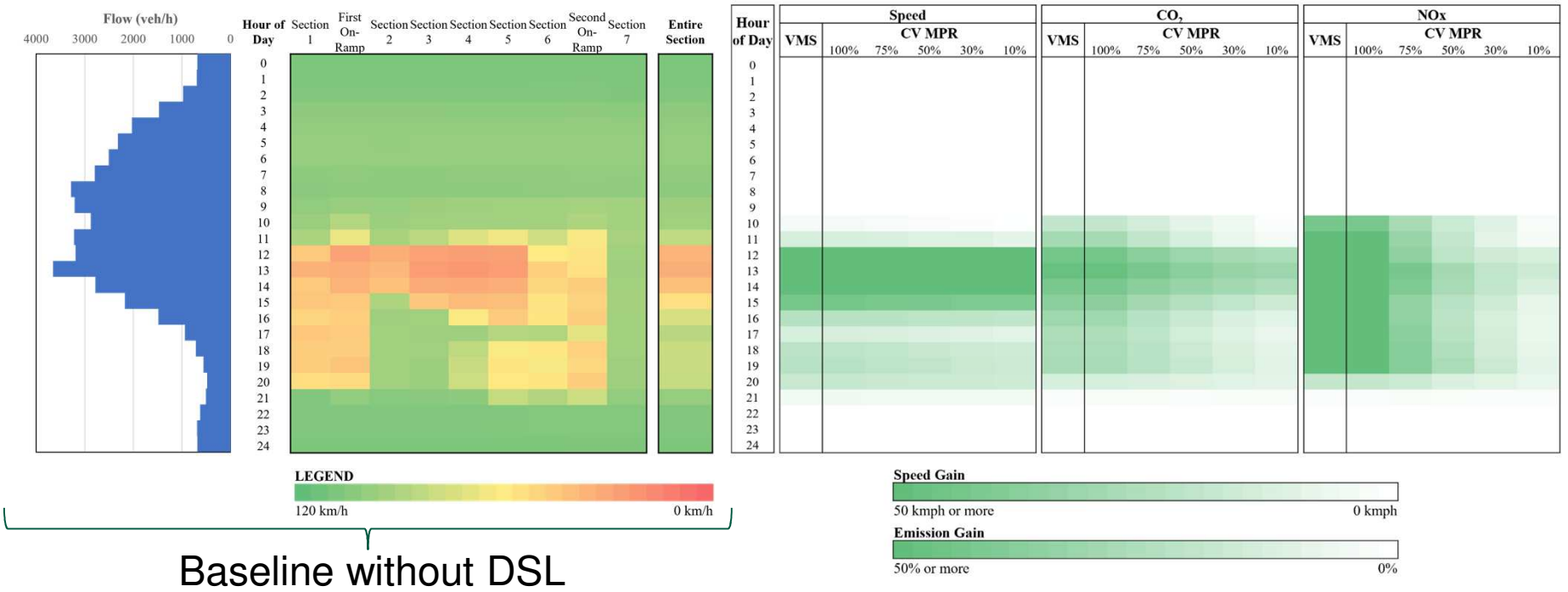
+ **Some further studies** are performed to highlight the impact of the Connectivity on DSLI with regard to
    + Market Penetration Rate:
        + Even at low MPR, DSLI is considerably effective: at least +25km/h on the average speed since MPR=10% on highway
        + 30% of connected Vehicles is enough to positively influence traffic stream performance
    + Tighteness of the telecommunication network coverage:
        + Providing speed instructions upstream **[-500m; 0m]** of the event location is **more effective** than downstream
        + Providing speed instructions too further upstream **(≥1000m)** of the event location **reduces effectiveness** at low MPR: CVs are overtaken by other vehicles
        + The **delay to update** the information (due to the gap in the coverage) does not sinificantly affects the traffic efficiency for gaps in the range **[0; 5km]**





Main findings about DSL

Benefits with
a realist demand profile



Baseline without DSL

Main findings about GLOSA

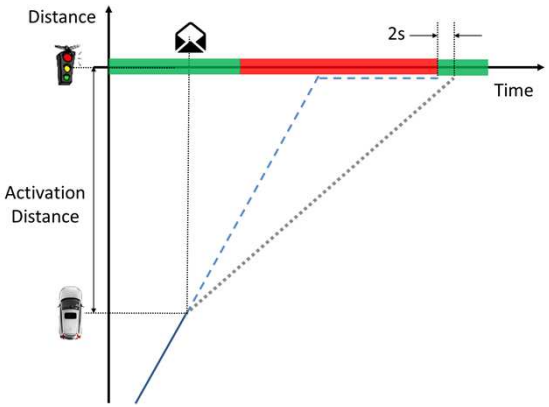
+ According to FOT, prefer

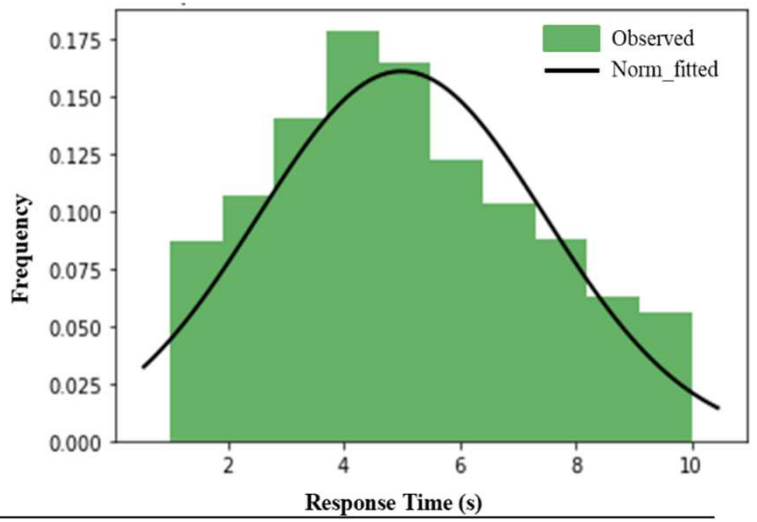
  + to apply GLOSA at relatively **short activation distance** (100m & 200m) to ensure higher response rate, quicker and stronger response.

  + **High speed differences** between advice and current speed **negatively affects the speed compliance** degree but support **stronger and quicker response**, while a **better response** rate is expected with **medium speed differences** (~15 km/h).

  + The **average response rate** of C-ITS users is around **70%.**

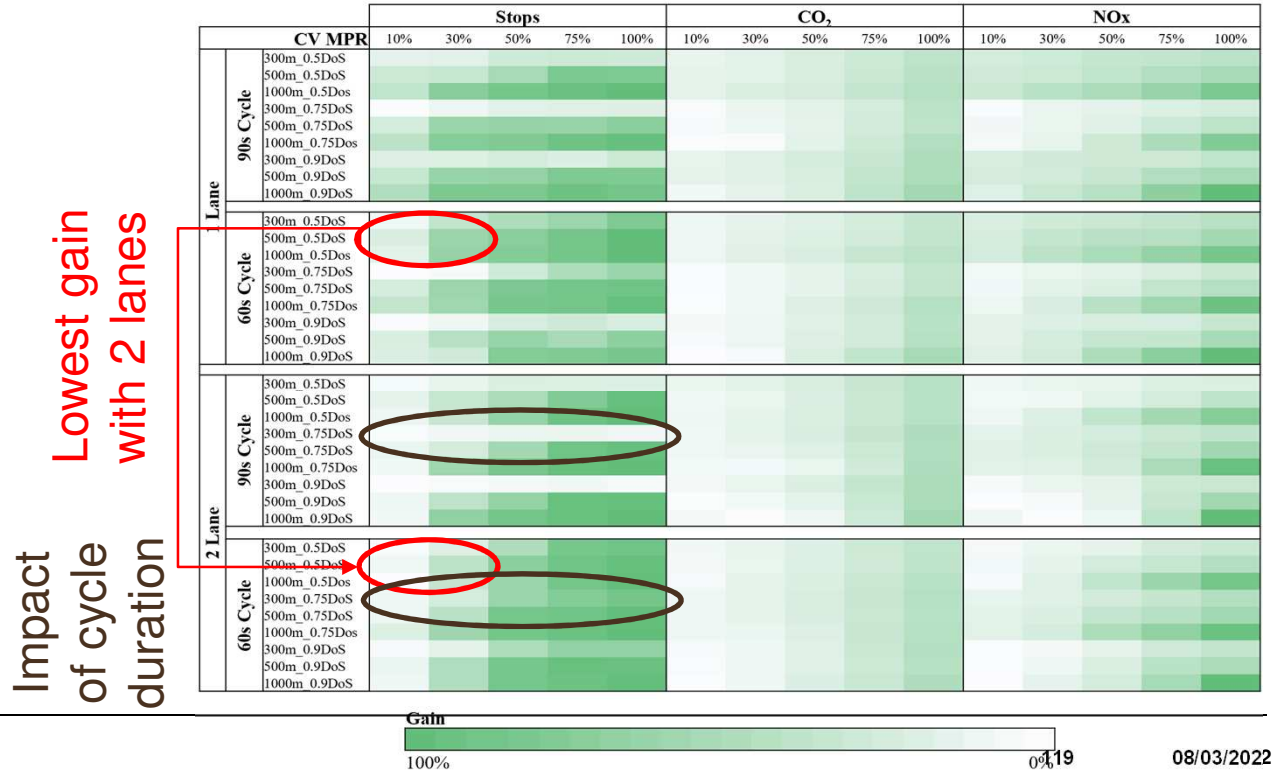
  + The **average response delay** of C-ITS users is around **5s**, before a significative change in speed is observed.





Main findings about GLOSA

+ According to **scaling-up** process, prefer to apply GLOSA
  - + at **medium degree of saturations** (~50%) to avoid the impact of traffic conditions on performance
  - + on **1-lane** configurations to avoid overtaking vehicles
  - +at **longer activation distance**, when the **cycle length is higher**



Generic Findings and Perspectives

+ **In periurban / motorway areas:**
  + Compared to other communication technologies (e.g. Variable Message Signs), the V2I communication might reach equivalent performances in average speed since the Market Penetration Rate is higher than 30%. With heavy traffic, lower MPR are sufficient.

  + With regard to Variable Speed Limit and depending on the implementation, the mesh of the RoadSide Units network might affect the global performances.

    + Enabling RSU antennas to display (non critical) messages out of its coverage area has a limited impact on VSL performances (until 5km between antennas)

    + It is recommended to display VSL messages slightly in advance/upstream (between [500m; 1km]), but not to much to avoid side effects

+ **In urban areas**
  + The **acceptance rate** of speed recommendations is estimated around **70%**.

  + The **average response time** between the emergence of the message and a significative change in trajectory is around **5s,** it means that some delays should be included when computing the speed recommendation.

  + **Higher response rate, quicker and stronger responses** are observed for **activation distances** between 200m and 100m, but the **benefits** (number of stops, CO2 emissions) are **higher with longer activation distance** or **strongly depend on the cycle duration**.

  + The **benefits of GLOSA depends on the traffic density**. The current implementation does not take into account the queue effect, but only a constant delay set to 2s. As a consequence, the benefits are higher for medium traffic density. Some further studies are including the queue effect and can maintain the benefits with heavy traffic conditions.

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

Co-financed by the European Union
Connecting Europe Facility

C-ROADS
FRANCE

InDiD
Infrastructure Digitale de Demain

WEBINAIRE

Behavioral study of level crossings use cases

Research study

+Problem:
Level crossing accidents represent an average from 100 to 150 collisions and from 25 to 35 fatalities per year.
99% of these accidents are due to voluntary or involuntary non respect traffic rules volontaire ou involontaire (infraction, distraction, erreur de conduite)

+Hypothesis:
As cooperative intelligents transports systems improve road safety, C ITS could improve safety at level crossings

This study was carried out from April to May 2019 on a panel of 25 subjects

Simulator and experimental situations

+Dynamic driving simulator, vehicle (Renault Twingo) on a platform. Image projected on screen offering a fleld of 150° visions

+The course consists of :

✓ 3 « references » situations (based on actual infrastructures) with open and closed LC

✓ 6 situations with « connected » LC broadcasting message on status

+Duration : from 20 to 30 minutes by each simulation and from 40 to 60 minutes by each interview

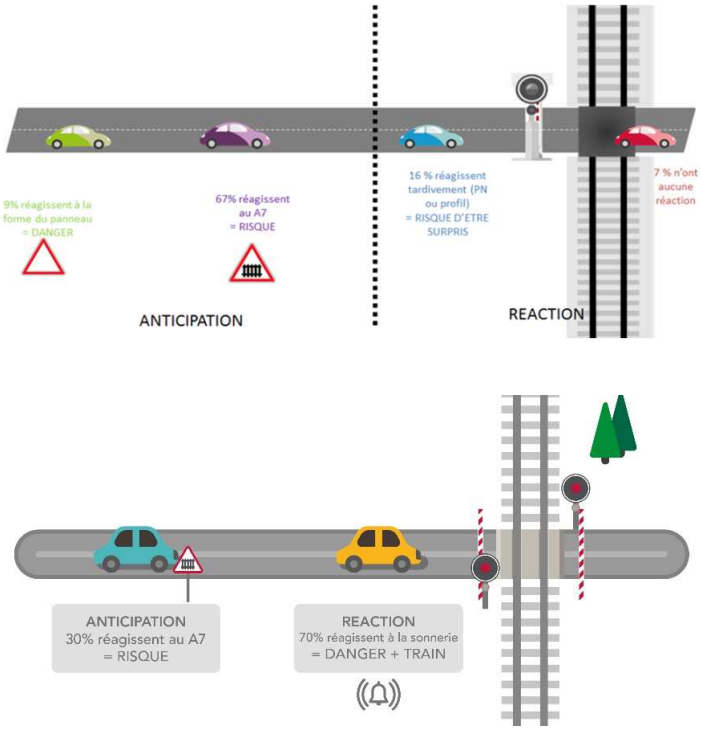
Results: reference situations

+ At LC open and closed, we observe 2 types of behavior :

✓ Subjects in nticipation thanks to A7 pannel or J10 beacons and adapt their speed to prepare for a possible stop

✓ Subjects in reaction, waiting for the flashing light or descent of the barrier to understand that they are going to stop

+ Subjects who do not anticipate could find themselves in difficulty if the LC is triggered with a speed that does not allow them to stop safely



Results: LC closed message « LC closed at x meters»

+ 2 messages tested with different pictograms (R24 and stop sign)

+ Average comprehension for these 2 situations:
  - ✓ 63% of subjects anticipate thanks to text of the message
  - ✓ 15% of subjects anticipate thanks to beep or message
  - ✓ 6% of subjects do not understand the message
  - ✓ 8% of subjects do not take the information into accour
  - ✓ 8% of subjects are refractory

+ In the illustrated situation (opposite) 92% of subjects anticipate the LC closing by different methods (beep, message or beep + message).

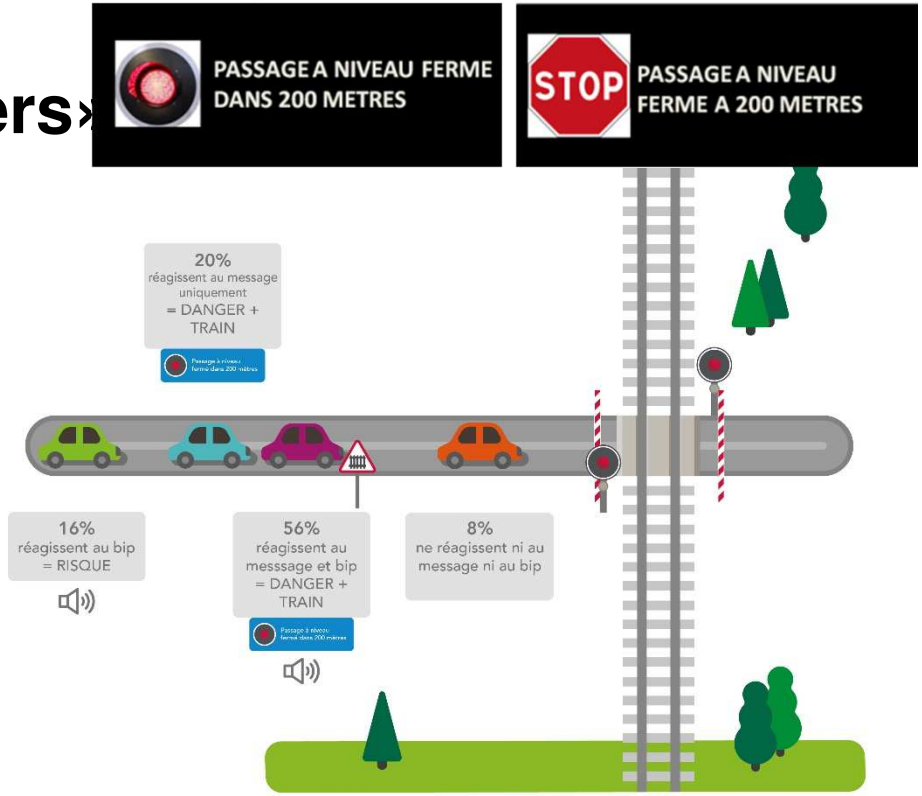


Figure illustrating situation of LC closed messagewith pictogram R24

Results: situation LC open message « LC at xx meters »

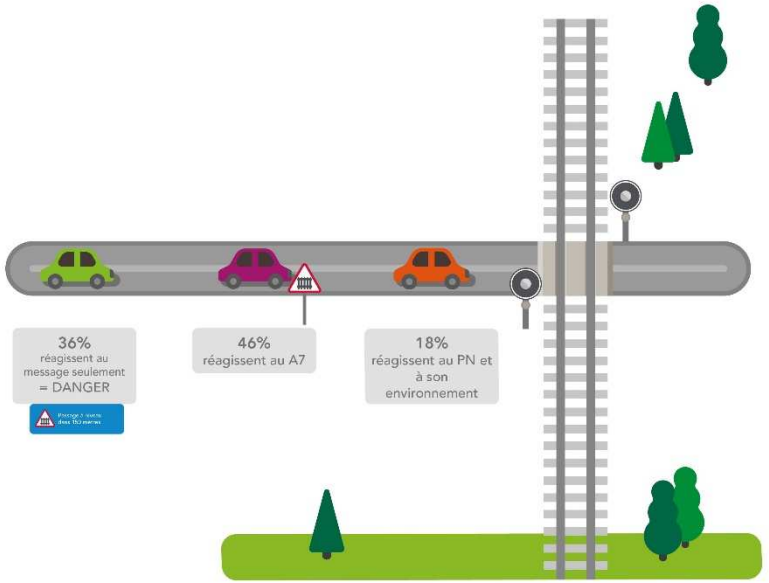
+we observe that :

✓36% of subjects react to message

✓46% of subjects react to A7 panel

✓18% of subjects react to LC (profile, LC open)

+This kind of message is complementary to A7 panel and enable to anticipate before.



Results: situation without message

+We observe that :
✓61% of subjects approach LC as a classic approach whether or not they observed the absence of a message
✓17% of subjects think that LC is open

+Indicate LC closed, implies that some drivers think that the absence of message means level crossing open.

Results: abnormal situation « Danger! A train could coming soon»

+Message visibly alerts drivers even if levels of understanding are different

+All approach LC imagining a danger, most often the passage of a train, which is positiv

- 26% sujets n'ont pas vu le message
- 74% sujets ont lu le message dont
  - 59% imaginent qu'un train va arriver
  - 23% imaginent un dysfonctionnement
  - 18% ne comprennent pas la situation/le message et réagissent au visuel du PN

Results: situation of works message « Road closed, LC in works »

+We observe that :

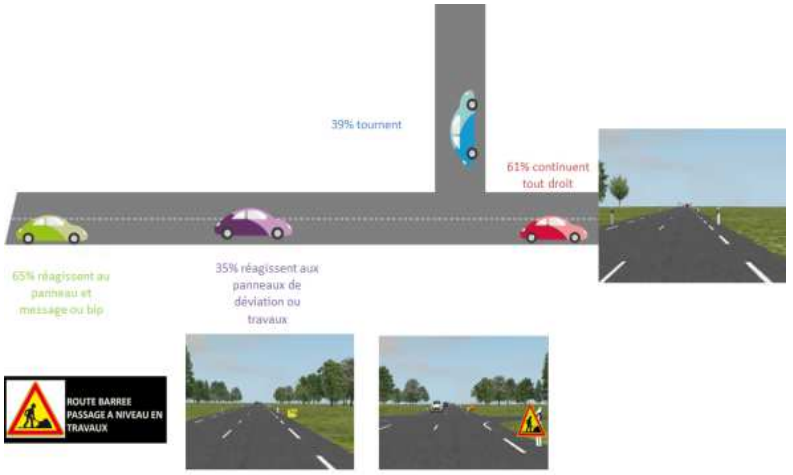
✓15 subjects saw themessage

○80% understood that they had to turn to left to take the deviation,

○Others imagined works close to LC but which did not prevent them from crossing it.

✓8 subjects did not see the message

+In the majority the message reinforces the subjects in their understanding of the situation



Conclusions

+ 8% of subjects are resistant to screen devices (GPS, smartphone application, etc.)

+ Unequivocally, like the example of “closed level crossing”, associated with an audible signal, the messages can lead to an early slowdown of up to 92% of the subjects for one of the situations.

+ In case of doubt (ie Level crossing in 200 meters), the messages must be prolonged by reflection and have variable results, in relation to the capacities of the subjects to anticipate. However, they avoid the phenomenon of distraction and are complementary to the A7 panel (announcement of the LC).

+ The results should be taken with caution because we were unable to assess the cognitive load of LC messages among a course with a multitude of ITS messages. This topic was investigated in a new study carried out in 2021

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

InterCor

BREATHER – PRESENTATION VIDEO OF WORKS OF SNCF ON C-ITS

C-ROADS FRANCE

Co-financed by the European Union
Connecting Europe Facility

InDiD
Infrastructure Digitale de Demain

MINISTÈRE
DE LA TRANSITION
ÉCOLOGIQUE

Liberté
Égalité
Fraternité

START OF OPERATIONS

Marie-Christine Esposito

Head of road information, information systems and C-ITS office

C-Roads France and InDiD coordinator, chair of C-Roads Platform

Co-financed by the European Union
Connecting Europe Facility

1. Reminder : French C-ITS pilot projects, levels of operations

C-ITS deployment stakes for France

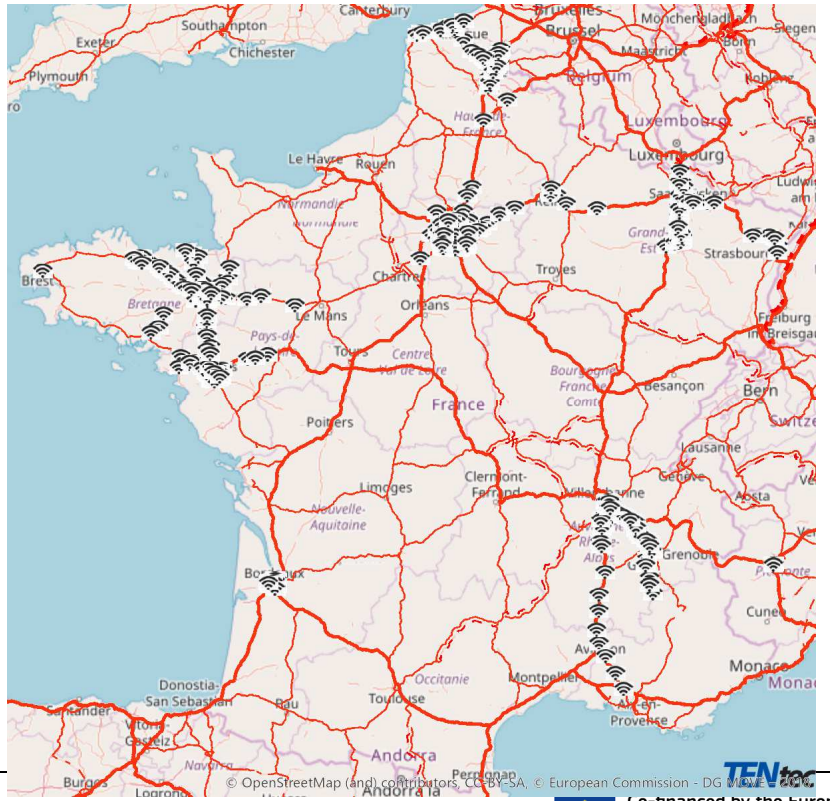
- Improve road safety for both road users and roads operating agents
- Enhance traffic flows management and reduce traffic congestion
- Optimize traffic information
- Enhance connections between networks managed by the various operators, including multimodal perspectives
- Develop new services for road users
- Deploy a road infrastructure in line with the technological needs of connected and autonomous vehicles

Co-financed by the European Union
Connecting Europe Facility

C-ITS deployment in France

Deployments achieved as part of the co-financed projects by the EC (50%)

- **Nearly half a thousand RSU**
- **A few hundreds on-board units (road operators)**
- **Everything covering about 5000 km in France by end of 2023**



Co-financed by the European Union
Connecting Europe Facility

Main learnings from pilot projects

- **Necessity to deploy services to benefit from road safety gains**
- **Facing operational implementation takes time and the sooner it is tackled, the better**
- **Harmonisation between stakeholders is key**
- **Trust between stakeholders is key**
- **To ensure this trust, a proper and important validation process is necessary**

Co-financed by the European Union
Connecting Europe Facility

Stakes of this start of operations

- Road operators want their RSU, installed as part of the pilot projects, to be useful for actual services to actual road users
- Necessity to face operations at a large scale
- Identify the last blocking points to a complete deployment

Co-financed by the European Union
Connecting Europe Facility

Deployment levels

▪Level Pre-L1 :

- ▪Objective of operations to exchange messages with connected vehicles currently on the roads, using bilateral agreements if needed
  - ▪Operate installed RSU as part of the projects for long term use so that they can bring services to regular road users
  - ▪Operate nationally the cellular chain, for Coopits usage at least
- ▪French security concept definition
  - ▪Identifying the production level that French operators can reach at this point

▪Level 1 - L1 :

- ▪Objective of conformity with the CPOC annex document defined during the EC security subgroup
- ▪Few exceptions to CP and SP on stations and PKI
- ▪The goal being to stay realistic at this stage in terms of operations, and what is reachable
- ▪If everything goes according to plan, pre-L1 level will actually not exist, and L1 will be achieved directly

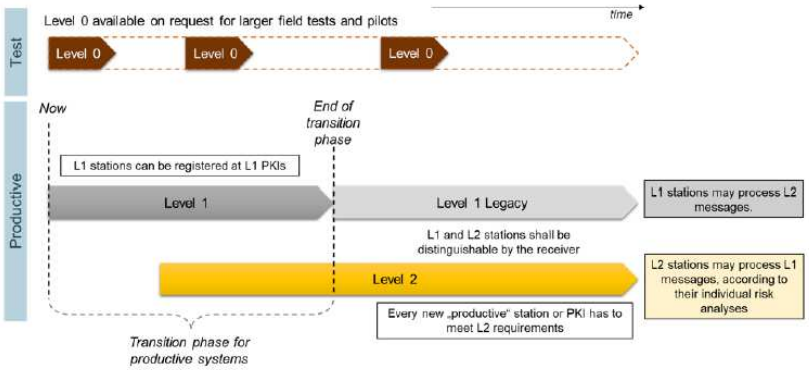


Figure 8 – Overview and timeline of ECTL levels

▪Level 2 - L2 :

- ▪Objective of complete conformity to CP and SP
- ▪For road operators, the goal is to have no legacy stations

Co-financed by the European Union
Connecting Europe Facility

2. Start of operations pre-L1

Identified actions, currently being tackled

- Consolidated the topic of legal responsabilities for infrastructure operators
- Finalise impact studies on data protection and privacy for each type of equipement
- Check the conformity with the French « interface security contract » and define an acceptable but reachable pre-L1 level
- Finalise the start of operations process following validation:
  - At the scale of one specific equipment
  - At the scale of one full site operating a C-ITS (from TCC to RSU or from TCC to Coopits)
- Continue the faisability analysis of start of operations for each site, for each information direction and for each use-case
- Define appropriate levels of services to ensure (in terms of disponbility, supervision, maintenance, messages loss, etc.) and set them up
- Fiabilise strategic equipment of both chains: TCC and PFro

Co-financed by the European Union
Connecting Europe Facility

4. Start of operations L1

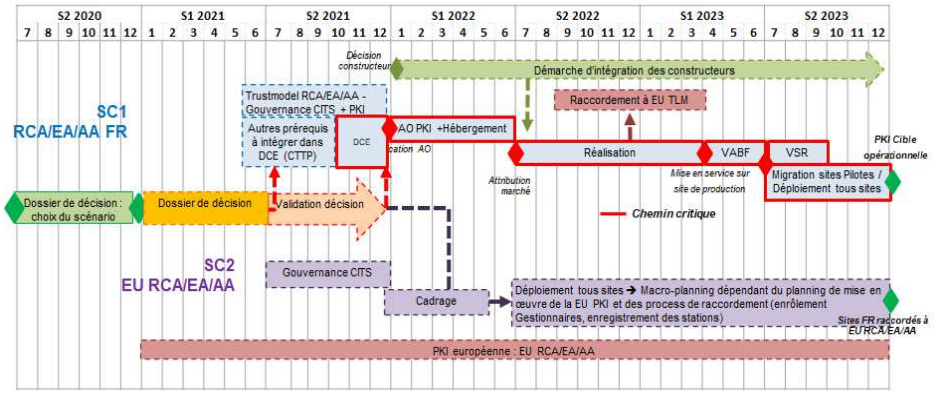
Identified actions, currently being tackled

- Detailed analysis of the european L1 document, with French C-ITS stations providers and check of feasibility
- Realisation of necessary audits and penetration tests
- Check of full conformity to release 2.0 of the C-Roads platform, including cross-border tests

5. Start of operations L2

Identified actions, currently being tackled/prepared

- Study on French PKI
  - Objective : have or connect to a PKI that is compliant to the CP by end of 2023
  - First step: definition of a retroplanning
  - Second step: choice between a French PKI or the European PKI
    - Consultation with French stakeholders : infrstructure operators (road, railway), OEMs, public transport operators, collectivities, interior ministry, etc.
  - Third step: start of a tender if French choice is confirmed



Co-financed by the European Union
Connecting Europe Facility

Identified actions, currently being tackled/prepared

- Definition of a new French governance beyond the pilot projects, accompanying this PKI
  - Strategical gouvernance
  - Technical gouvernance

- Work on systems homologation, to go beyond the validation processes set up during the pilot projects
  - As an example, participation to the « protection profile » works of the C-Roads platform

6. Conclusion

- Road operators in France do not want to wait anymore to provide actual users actual services, despite the known limitations

- While waiting for a larger deployment of connected vehicles, services continue to develop on the smartphone application so that the hybrid architecture can be used

- Remaining work is still important to define the framework of this start of operations beyond the pilot projects

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

EUROPEAN
COMMISSION

C-ITS industrialization and deployment

Roundtable

C-ITS Webinar 8 march 2022

MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté
Égalité
Fraternité

Roundtable outline

EUROPEAN COMMISSION

- **Issues at stake**
  - Expected benefits and restraints of C-ITS' industrialization and deployment
  - Expectations towards # stakeholders' roles
- **Participants**
  - DGITM (introduction)
  - Road operators
    - Département de l'Isère (Jean-Christophe MAISONOBE)
    - Société des autoroutes Paris Rhin Rhône (Pascal PHILIP / Benoit VUADELLE)
    - Vinci Autoroutes (Laurent BESSOU)
  - OEMs
    - Renault (Frédéric JOLY)
    - Stellantis ((Vincent ABADIE / Saleh BENSATOR)
  - Rail
    - SNCF (Luc LAROCHE)
    - EPSF (national rail safety authority) (Laurent CEBULSKI)

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

C-ITS industrialization and deployment

Introduction

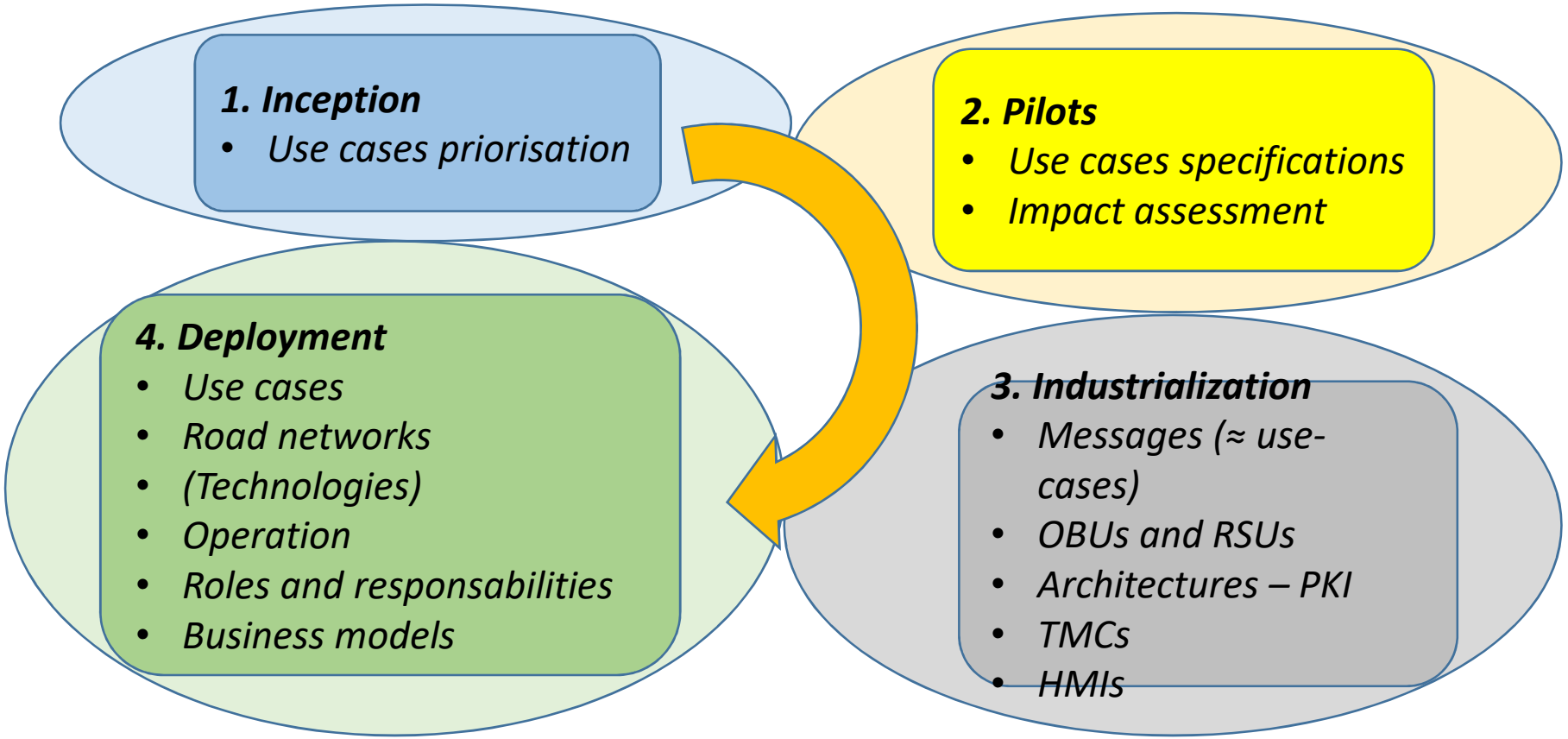
Xavier DELACHE

Direction des mobilités routières

Webinar C-ITS 8 march 2022

MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté
Égalité
Fraternité

From inception to deployment



MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté
Égalité
Fraternité

C-ITS use cases : back to priority setting in an EU perspective

Macro-use-case or bundle	Safety	Travel time	Envir.	Motorway	Inter-urban	Urban
Road works (incl. maintainance)						
Weather conditions (incl. slippery)						
Stationnary / slow / breakdown / accidented vehicles (incl. end of queue) or objects						
Intersection, crossing & traffic light management						
Rail level crossing management						
Vulnerable road users						
Parking availability (incl. EV charge)						
Modal transfert management (incl. P&R)						
In-vehicle speed limits signage						
Traffic and access regulations (incl. low emission zones, delivery, bridges, tunnels, managed lanes, overtaking bans)						
Enforcement / priority vehicles or agents						

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

C-ITS priority use cases : non EU perspective

- Korea
  - Bus Information
  - Fare & Toll Collection
  - Advanced Traffic Management
  - Advanced Traffic Signal
  - Automatic Traffic Enforcement
  - Parking Information
- Japan
  - Toll collection
  - Parking
- US (DOT's pilots)
  - Speed Compliance (including work zone ; curve)
  - Forward collision warning
  - Spot weather
  - Intersection & crosswalk management and safety (incl. vulnerable road users)

MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté
Égalité
Fraternité

C-ITS use cases : economic perspective

- C-Roads Use Cases : road safety counts for ~ 95 % of expected benefits
- ITS Directive : time savings count for ~ 80% of expected benefits

	Road safety	**Time savings**
Information and booking services for travellers	=	+++
Information and booking services for drivers	+	+++
Travel management services	++	++
Road safety and security applications	=	=

- Costs : In-vehicle : 60% - 80% ; Roadside : 15% - 30% ; Central : 5% - 10%
  - *Source : revised ITS Directive - impact study*
- Users' willingness to pay and marketable value ? time saving > road safety ?

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Jean-Christophe MAISONOBE

Département de l'Isère

Webinaire C-ITS 8 mars 2022

Département de l'Isère – Expected benefits from C-ITS

1- Ease traffic management : allow road operator to limit impacts of events on traffic

Challenges : road safety ; traffic fluidity ; user comfort

Objectives : - Improve capabilities to collect real time information on events

- Improve capabilities to inform road users, locally in real time

Examples : - Events on montain roads, vulnerable to natural hazards in a non-meshy network

- Real time information on winter driving conditions

2- Opportunities to better secure interventions on fix / mobile road works

Challenge **:** road safety

Objectives : inform approaching road users ; warn intervention personnel

Examples : winter maintainance operations (more frequent on mountain network)

3- Opportunity to enlarge information

- Road operator : traffic data collection
- Road user : Information on multimodal mobility solutions ; Points of Interest (POI)

4- Other opportunities to be explored according to urban local authorities' use cases

- Intersection safety ; vulnerable road users (e.g. cyclotourism)

Département de l'Isère : restraints to C-ITS deployment

- **1- Challenges for local authorities**

  - **Environmental footprint** (digital technologies' impact in a widespread scenario)
  - **Territorial equity** : whole network equipment seams out of reach
  - **Road safety efficiency** (distraction effects are specific on rural + mountain roads compared to motorways)
  - **New failures and vulnerabilities towards cybercrime**
  - **Privacy protection**

Département de l'Isère : restraints to C-ITS deployment

- **2- Operational restraints for road operators**

  - Utility : Absence or quasi-absence of vehicles equiped
  - Costs
    - C-ITS infrastructure's operation and maintainance costs for local authorities
    - Investment costs for road network coverage at scale of a Département
    - Extended and heterogenous road network in terms of traffic
    - Civil works for RSU implementation higher than on motorwyas or urban networks
      - Example of possible response : integrating multi-sensors + V2X
  - Technical strategy for RSU reployment
    - Complete network coverage seems irrealistic
      - Example of possible response : integrating multi-sensors + V2X

Département de l'Isère : Freins à l'industrialisation C-ITS

- **2- Operational restraints for road operators (cont'd)**
  - Technical strategy for RSU reployment
    - Possible deployment criteriae
      - Priority location for information broadcasting
      - Priority regarding challenges
        - Traffic volume (average or peak) ; hazards importance (exposure + criticity) ; information relevance for specific use cases (P&R ; POIs ; winter maintainance)
        - User's point of view : re-routing opportunities, parking facilities, U-turn possibilities..
        - Implementation conditions : existing physical installations ; access to telecom & energy networks ; maintainance possibilities
        - Ex : location mutualized with data collection equipments
      - New priority criteriae to be explored : information broadcasting + data collection via V2V

Département de l'Isère : Freins à l'industrialisation C-ITS

- **2- Operational restraints for road operators (cont'd)**
  - Required technical skills : might be difficult to fullfill for local authorities (e.g. absence of traffic management center ; low usage of dynamic equipments)
  - Other restraints to be investigated :
    - SCOOP platform compatibility and geographic reference used for local networks
    - Cybersecurity and PKI management

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Pascal PHILIP / Benoit VUADELLE

Société des autoroutes Paris Rhin Rhône

Webinaire C-ITS 8 mars 2022

STAKEHOLDER'S VIEW
ON EXPECTED BENEFITS AND RESTRAINTS TO DEPLOYMENT

Benefits :

- A strong contribution to road safety for motorists but also for intervention personnel (managers, law enforcement, emergency services, etc.)
- A contribution, help for drivers to fight against drowsiness or distraction
- Optimized traffic management for drivers in compliance with the instructions issued by the authorities
- Better understanding by drivers of police signs during speed limits (works, pollution plan, etc.)
- Direct information in the event of danger, to the motorists concerned (example: wrong way)
- Local information on traffic conditions but also on services located on the road (areas, fuel, etc.)

STAKEHOLDER'S VIEW
ON EXPECTED BENEFITS AND RESTRAINTS TO DEPLOYMENT

Restraints :

- Final investments and maintenance costs in operation (funding excluding experimentation)
- Progressive analysis of the risk in the sharing of responsibilities according to the expected service levels
- Absence of a normative framework for medium-term technologies and systems (technology for transmission, sizing of data processing systems, etc.)
- Complex compatibility and certifications for deployment (ISO 27001), requiring significant work to obtain certification

EXPECTATIONS

- **Global framework / guidance on :**
  - The development of a technical standard for the collection, processing and exchange of data
  - A legal position vis-à-vis usages
  - Funding from a generalization perspective

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Laurent BESSOU

Vinci Autoroutes

Webinaire C-ITS 8 mars 2022

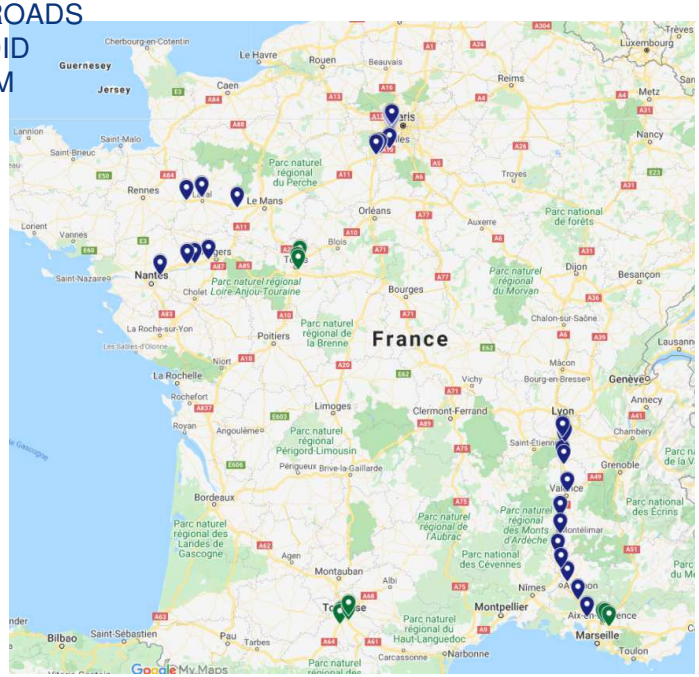
VINCI AUTOROUTES & C-ITS

VINCI Autoroutes

- ✓ 3 Concession companies : ASF, COFIROUTE et ESCOTA
- ✓ 4400km of highways

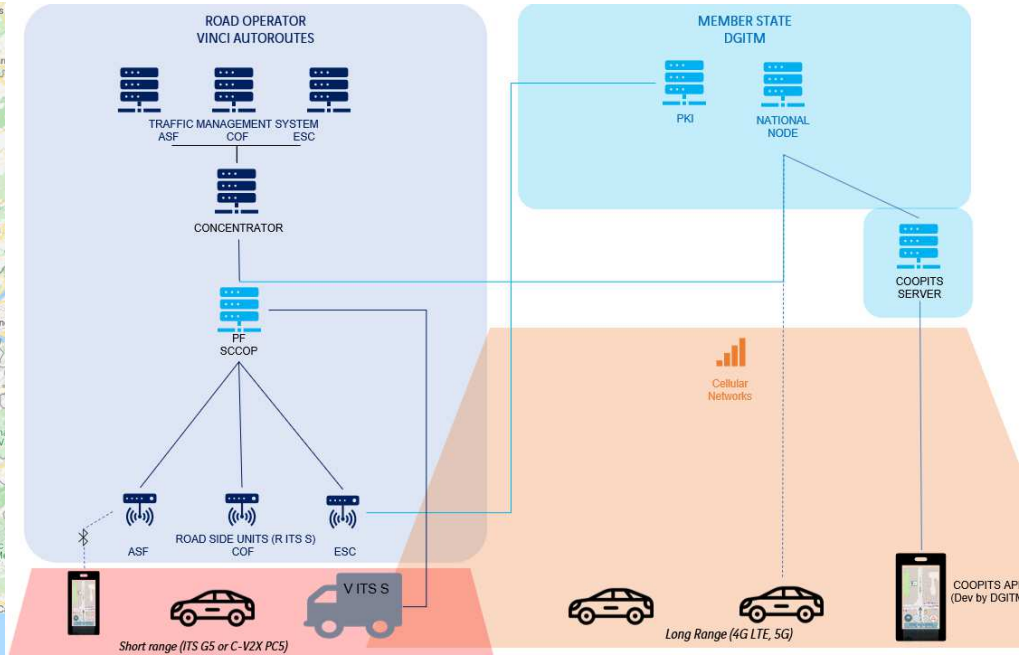
Partner of several connected and autonomous mobility projects

- ✓ C-ROADS
- ✓ INDID
- ✓ SAM



Equipment

- ✓ 3 TMS
- ✓ 1 Data Exchange PF (Concentrator)
- ✓ 39 RSU installed (blue)
- ✓ 10 RUS to be installed mid 2022 (green) (Tours, Toulouse, Aix en P.)
- ✓ No OBU



VISION OF INDUSTRIALIZATION

I – Large scale deployment on French highways to reach full safety benefits :

- ✓ Full coverage on high traffic sections and singular points (interchanges and toll stations)
- ✓ On highway operator vehicles (vans, trailers …) on the complete network

II – Coordinated approach with

- ✓ Government
- ✓ Other French road operators
- ✓ OEMs (Renault, Stellantis)

III – Technologies

- ✓ (ITS G5 and LTE V2X) able to implement upcoming standards. Backward compatibility with OEM already equipped (VW), Energy independent (with solar panels), or with energy backbone.
- ✓ Technology agnostic approach
- ✓ Interoperability

IV - 2 step approach for services

Day 1 Services with Road Side Units:

- ✓ Roadwork warnings
- ✓ Emergency vehicle
- ✓ Slow vehicle
- ✓ Vehicle breakdown
- ✓ Wrong way driver
- ✓ Weather notification
- ✓ Obstacle on the road

Day 2/3 Services with offboard complementary perception systems (roadside perception):

- ✓ Collision risk warning
- ✓ Merge/exit ramp
- ✓ Tolling approach

➔ **TECHNICAL AND ORGANIZATIONAL FUNDATIONS FOR UPCOMING CCAMs**

OBSTACLES & BENEFITS FOR INDUSTRIALIZATION

	OBSTACLES, CHALLENGES	FR & EU Expectations
€	**Financing** - Business models	✓ Financial support ✓ Legal Framework in particular in terms of technologies and data exchanges ✓ Coordinated governance with Member State, OEM and Road Operators leading toward a simultaneous deployment
	Large Scope of remaining work : ✓ Reach a minimum level of performances ✓ Information system security for the complete ecosystems (compliance with internal rules + EU rules) ✓ Implementation of a technical and operational processes for monitoring and maintenance ✓ Definition and implementation of Level of services ✓ Definition of deployment strategy ✓ Deployment	
	Legal responsibilities	
	Increase expertise in various domains ✓ Telecom ✓ EU PKI ✓ New V2X standards	
	Interoperability ✓ Technologies ✓ Data	

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Frédéric JOLY

Renault

Webinaire C-ITS 8 mars 2022

Freins au déploiement des C-ITS

08/03/2022

C-ITS deployment : restraints

RG

Penetration rates : The chicken and the egg.

- Need for visibility and a clear commitment on investments and deployment plans on the infrastructure side in Europe.

Introductory costs:

- Overall efficiency of C-ITS based on the penetration of the service and therefore on the geographical coverage and the percentage of vehicles, while the costs of introduction are not negligible on the infrastructure and vehicle side.

Attractiveness of Day1 services:

- Obvious benefits of DAY1 services from an accidentology point of view, but less interest from a customer point of view.
- Overlap of I2V services with existing applications and future deployments of RTTI and SRTI services on a European scale.

C-ITS deployment : restraints

European trust model necessary but insufficient:

- Incomplete response to cybersecurity problems, and only partially guaranteeing the quality and relevance of the information received, which therefore must be redundant by the vehicle sensors before autonomous decision-making.

Legislative and technological instability:

- ITS Directive listing principles but not resolving any issues.
- Challenge of backward compatibility not favoring investments.
- Principle of technological neutrality not well suited to a "Basic Safety" context.
- Situation on Standard Essential Patents worrying. (Cost, low European share)
- Cycle of renewal of wireless technologies too fast compared to the lifespan of vehicles and infrastructures.
- Diversion of R&D objectives from C-ITS services to "building block" technologies.

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

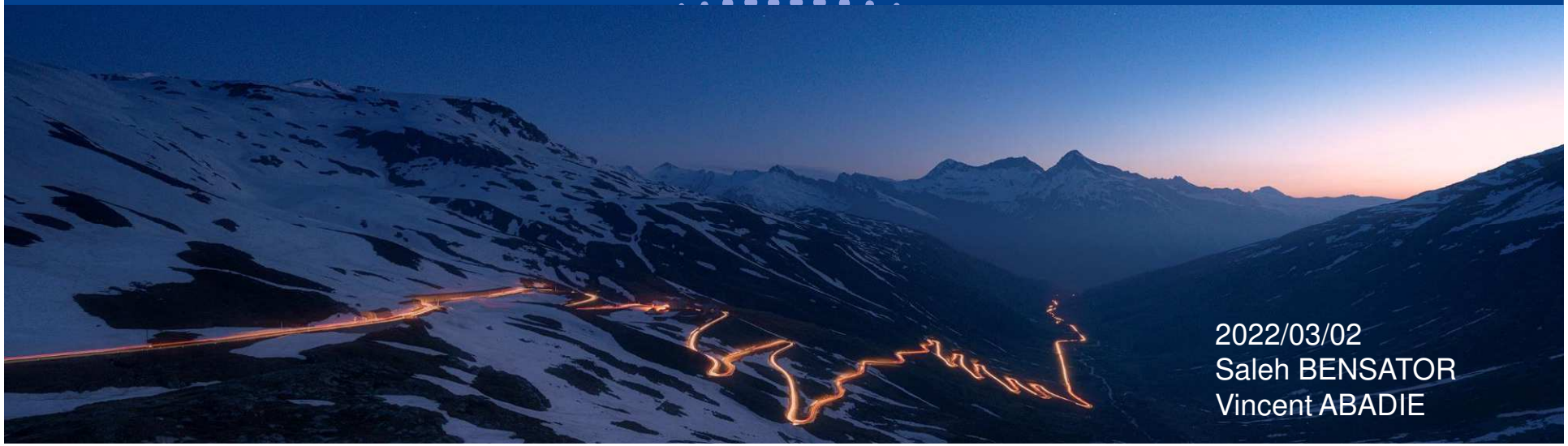
C-ITS industrialization and deployment

Vincent ABADIE / Saleh BENSATOR

Stellantis

Webinaire C-ITS 8 mars 2022

ITS BENEFITS / CONS



2022/03/02
Saleh BENSATOR
Vincent ABADIE

C-ITS BENEFITS

- **Improvement of road safety** and enabler to answer to futures NCAP and Regulation reguirements
  - Incident detection enabling road safety-related services
  - Global Safety Regulation (GSR) especially using speed limits reliable information
  - NCAP future protocols 2025+

- **Enabler for the integration of highly automated vehicles (L2 to L4)** in new multimodal mobility services:
  - Complementary information with respect to on-board sensing providing and extended detection range
  - Contruction zone information
  - Hazard events
  - Aligned with last revision of ITS directive

- **Safe and reliable information**
  - Information integrity and quality
  - Information Accuracy (position)
  - Trust model to be defined (use of information will depend on level of confidence)

- **Enabler to define liability share** between infrastructure and vehicle

- Note: The revision highlight the fact that requirements for C-ITS should neither impose nor discriminate in favour of the use of a particular type of technology => **Key topic for Stellantis (in a context of fragmented market in terms of technologies 5G / DSRC)**

C-ITS CONS

- **Benefit on road safety to be validated**
  - Technologies have evolved since the first evaluation of V2X road safety benefit
  - On board sensors with extended capabilities (camera, radars…)
  - Connected navigation in place in vehicles providing already some road hazard information

- **Added value**
  - Difficult to sell to end customer, who does not perceive the added value compares to existing systems

- **Deployment complexitiy**
  - Co-design needed between different stakeholders with high level of expectation (reliability / accuracy)
  - Integration complexity (e.g. cybersecurity)
  - Cross domain technology: IVI, ADAS, HMI etc...

- **Cost**
  - Hardware
  - Cybersecurity = reccurent cost linked to certificates
  - Communication cost (to be addressed)

- **Need to have a worldwide converged view on C-ITS**

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Luc LAROCHE

SNCF

Webinaire C-ITS 8 mars 2022

Industrialization of C-ITS for level crossings

Benefits	Restraints
Driving assistance for road users allowing them to anticipate their approach to the level crossing: 40% of accidents (those related to distraction, or driving error) could be avoided.	A solution very dependent on the acceptability and understanding of the road driver and which must be accompanied by national policies for training drivers through road safety
A security solution open to all national and European railway managers and ensuring interoperability at European level	The level crossing use case is not yet standardized to date, work is in progress at the ETSI level.The absence of a national deployment policy to ensure consistent territorial connectivity
Communication technologies standardized at European level as well as the implementation of a European cybersecurity policy via the European PKI guarantee the integrity of the messages exchanged.	A still low penetration rate of connected vehicles in the vehicle fleet

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Laurent CEBULSKI

EPSF

Webinaire C-ITS 8 mars 2022

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Industrialisation et déploiement des C-ITS

C-ITS industrialization and deployment

Wrap-up

Xavier DELACHE

Direction des mobilités routières

Webinaire C-ITS 8 mars 2022

MINISTÈRE CHARGÉ DES TRANSPORTS
Liberté
Égalité
Fraternité

Industrialization and deployment : main challenges

1. Need to review / update use-cases priorities (from inception to deployment)
   - Use-cases priorities might or might not be common among stakeholders
   - Network priorities might or might not be common among use-cases / stakeholders
   - Urban + Automated driving perspectives might (slightly ?) shift priorities
   - Business models (benefits for # stakeholders) need to be assessed further
   - Users' willingness to pay is not straightforward
2. Enablers are not purely technological
   - Financing – "cost and benefits sharing"
   - Skills (PKI, standards, telecom, maintenance)
   - Regulation of data exchanges *(cf. EU ITS directive + EU Data act + FR regulation)*
   - Quality of data / information
   - Responsabilities / liability
3. Towards a coordinated deployment strategy ?
   - Common set of "day-one-deployment" use cases / network to cover fixed costs ?
   - Governance process (EU / national) ?

MINISTÈRE
CHARGÉ DES
TRANSPORTS
Liberté
Égalité
Fraternité

Conclusions

Sandrine CHINZI

Road mobilities director

Webinaire C-ITS 8th march 2022