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

Seminar – 20th and 21st November 2019

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

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Evaluation Results

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Reminder Scoop's objectives

1. Improve safety of road users and road operating staff
2. Making traffic management more efficient and contributing to the reduction of emissions
3. Optimizing infrastructure management costs, making vehicles fit for the future and developing new services

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Agenda at a glance

- Evaluation results part 1 - 13h40/15h00
- Live demonstration – 15h00/15h30
- Coffe break– 15h30/15h45
- Evaluation results part 2 - 15h45/17h00
- Cross-border tests and European harmonization - 17h00/18h00

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Detailed Agenda

- Evaluation results part 1 - 13h40/15h00

Health risk assessment	Divitha SEETHARAMDOO
Acceptability study	Cécile BARBIER
Organisational impacts	Medhi CHAHIR
Legal aspects	Michèle GUILBOT
Q&A	

- Live demonstration– 15h00/15h30
- Coffee break – 15h30/16h00
- Evaluation Results part 2 - 15h30/17h00

Impacts on safety	Laura BIGI
Impacts on traffic and congestion	Andres LADINO
Cost benefit analysis and business model	Rémi POCHEZ, Christophe LARUE
Technical Evaluation	Hasnaâ ANISS
Q&A	

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Detailed agenda

- Cross-border tests and european harmonization - 17h00/18h00

Cross-border tests	José FERNANDEZ, Lara MOURA
C-Roads platform	Eric OLLINGER
Q&A	

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Health risk assessment

Evaluation of electromagnetic field exposure

Divitha Seetharamdoo
IFSTTAR/COSYS/LEOST

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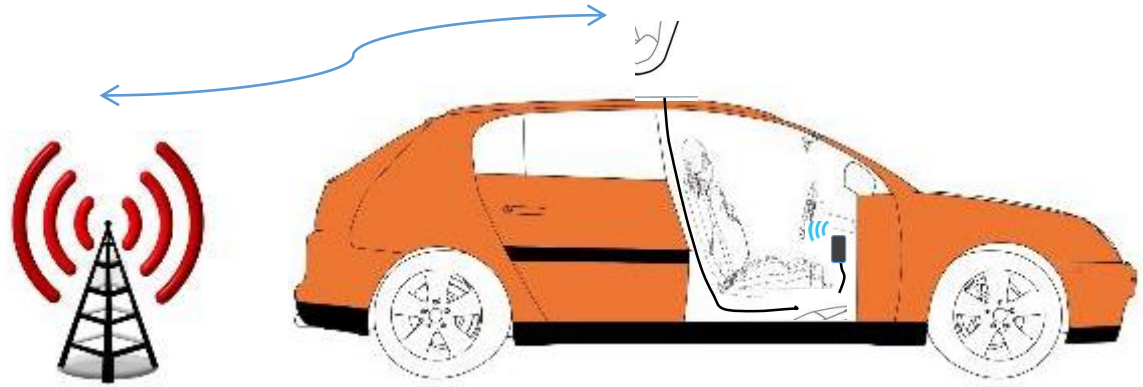
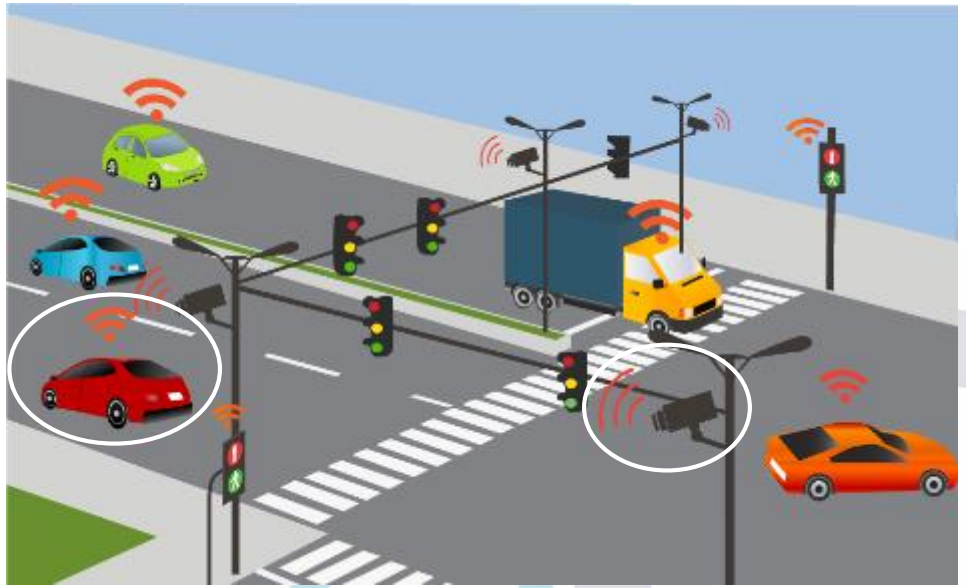
Context

- Deployment of 802.11p radiocommunication systems
  - Human exposure to electromagnetic waves due to the presence of supplementary RF sources



RoadSide Unit (RSU)

OnBoard Unit (OBU)



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Regulatory Framework

- Objective
  - Definition of guidelines and requirements for limiting exposure to time-varying electric, magnetic and electromagnetic fields
- European council recommandation 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)
  - Recommandation 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
  - Recommandation transposed in France by Decree 2016-1074

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Our objectives

- Analyse the exposure level due to EM emissions from systems deployed by the Scoop project

- Focus : Radio frequency electromagnetic emissions from the Roadside unit (RSU) and Onboard Unit (OBU
- Both public and occupational exposure

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Human Exposure analysis in the framework of Scoop project

- General principle of evaluation of Human Exposure to EM fields

- Analysis of the regulatory framework with respect to the EM emissions added by Scoop radio communication systems

  - Human exposure to EM fields assessment for on several roads with RSU deployed in an car equiped with an OBU

  - Assessment of maximum exposure level (instantaneous and averaged over 6 minutes) as well as the cumulative exposure

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Human EM exposure assessment

- ITS G5/802.11p systems
  - Max. equivalent radiated power (ERP) = 2 W
  - Center frequency = 5,9 GHz
- Evaluation of EM exposure : the main parameters

Illustrations : IFSTTAR, Epictura

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Human EM exposure assessment

- The integration constrainsts of the radiocommunication systems are essential factors influencing EM exposure
  - Within vehicles, this evaluation is the responsibility of the car manufacturers; they attest that the maximum exposure limit is respected
  - Outdoor, after deploying the RSU, a neutral body (e.g. a certified laboratory) in agreement with the ANFR (Agence nationale des fréquences) performs measurements and these can be made available to the general public

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Limits in the exposure levels

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- Application of the general regulatory framework to the emission sources introduced by the deployment planned in Scoop project
- Two different populations:
  - Workers (healthy adults exposed during working hours),
  - Public (24h exposure, 7 days/week for adults, children, old people...)

	Population générale Valeurs limites d'exposition	TRAVAILLEURS Restriction de base
Champ électrique de référence	61 V/m	137 V/m

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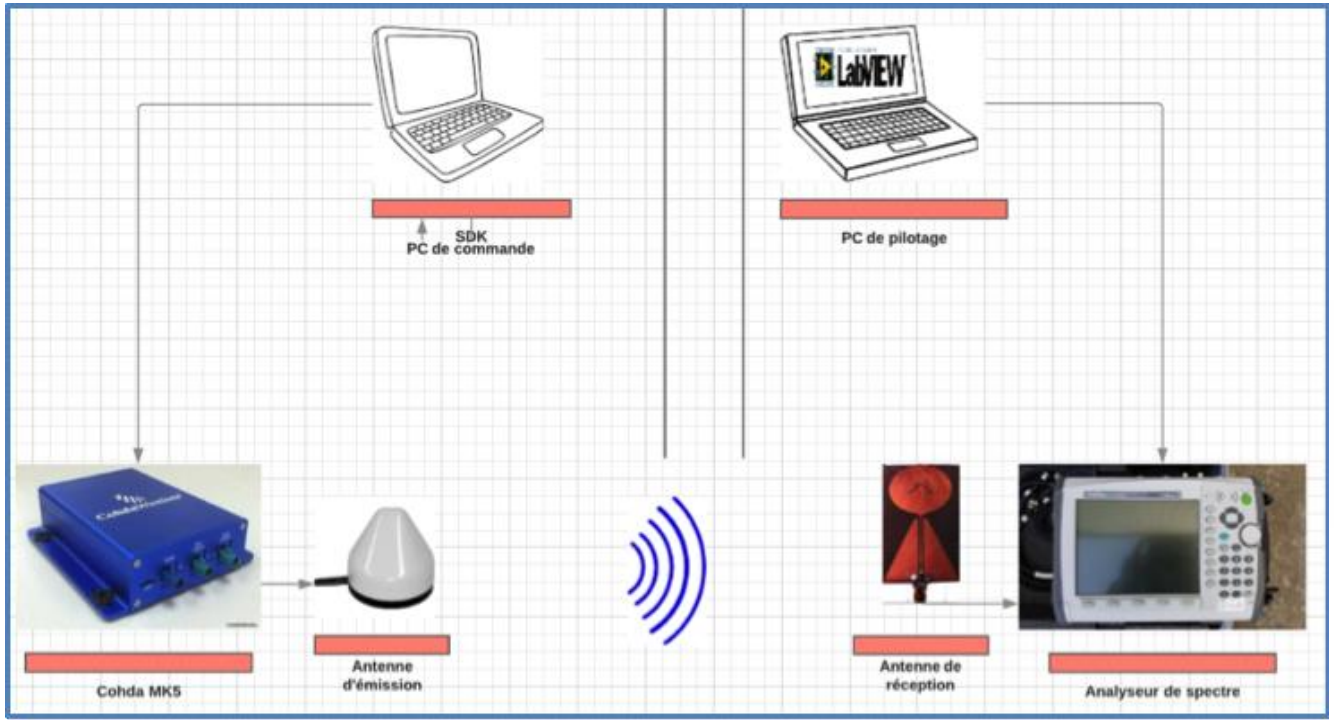
Problem statement

- How to detect and evaluate as acurately as possible the power of signals when ITS-G5 systems are in service...
  - Method: 2-step parameter setting (in laboratory controlled environment and on road environment)



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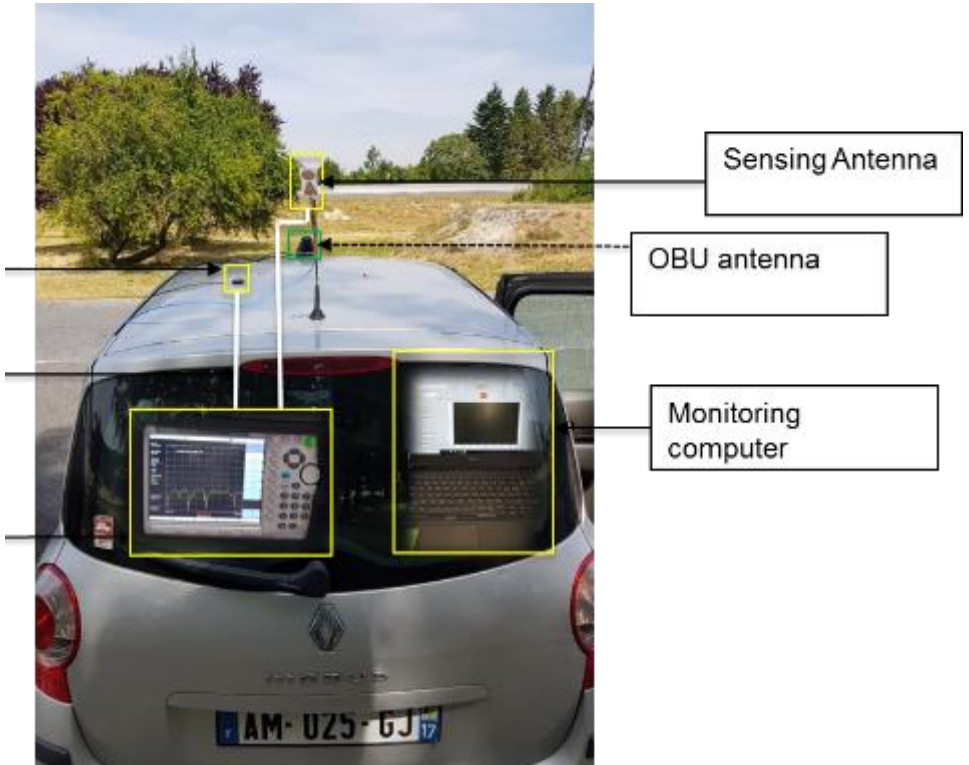
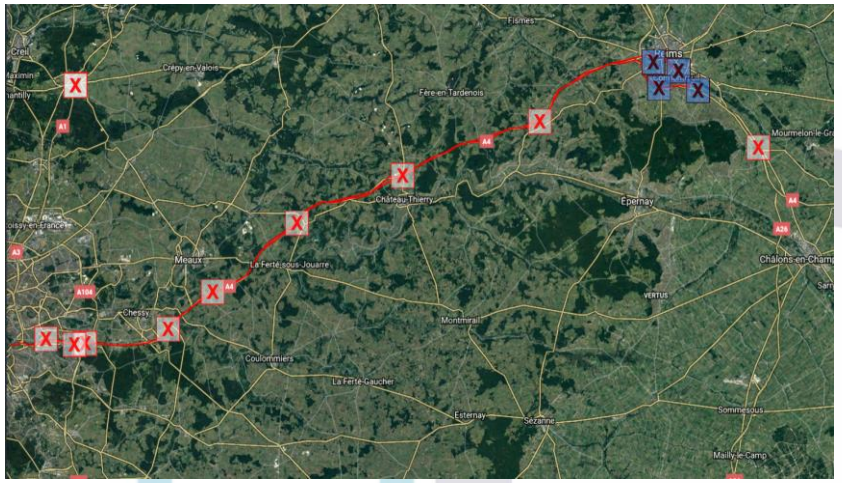
Description of evaluations performed

- Car equiped for experimentations
- A86 and N104 around Paris
- A4 Paris-Reims





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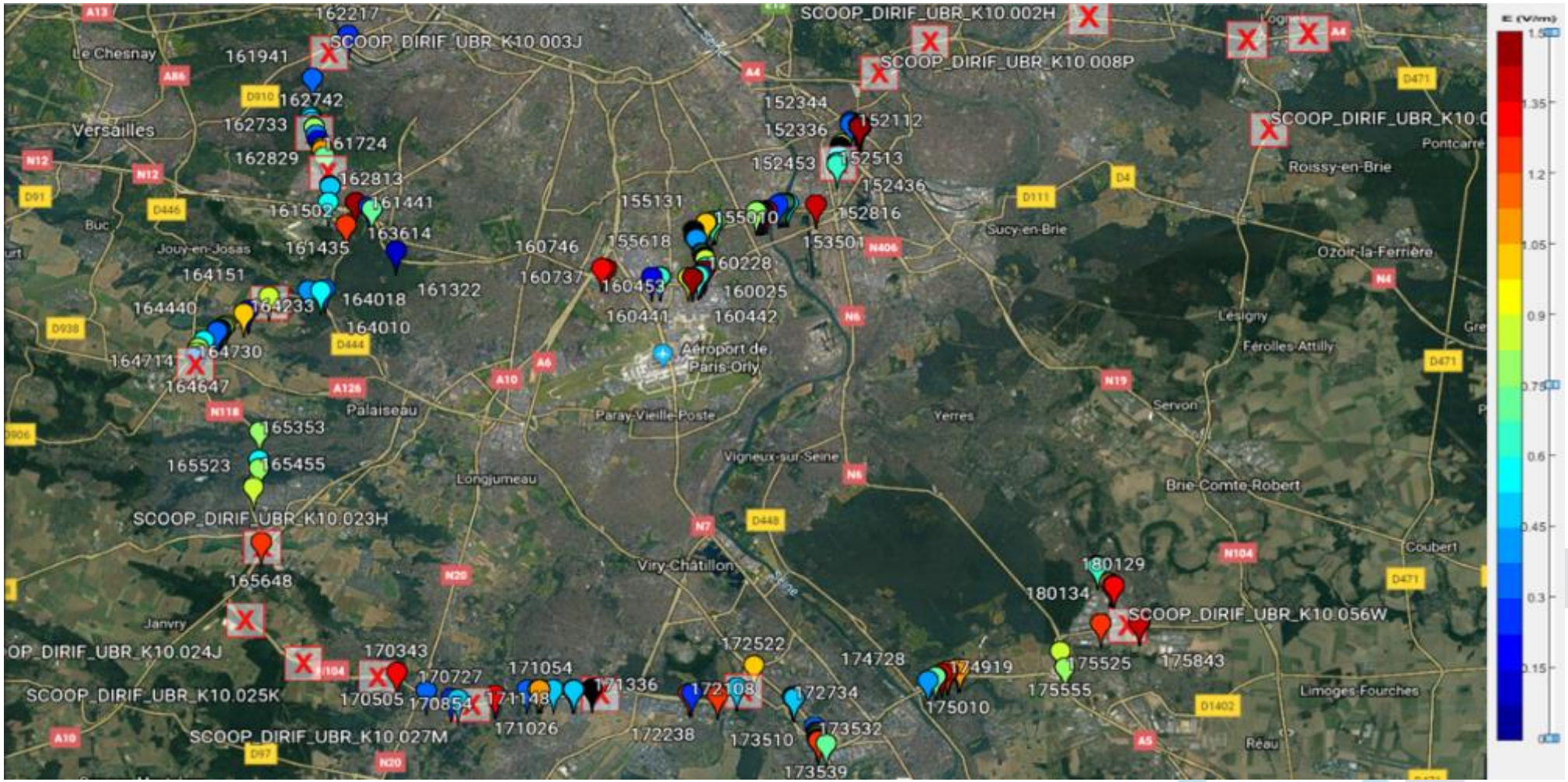
Results – Maximum instantaneous electric field (A86 et N104)



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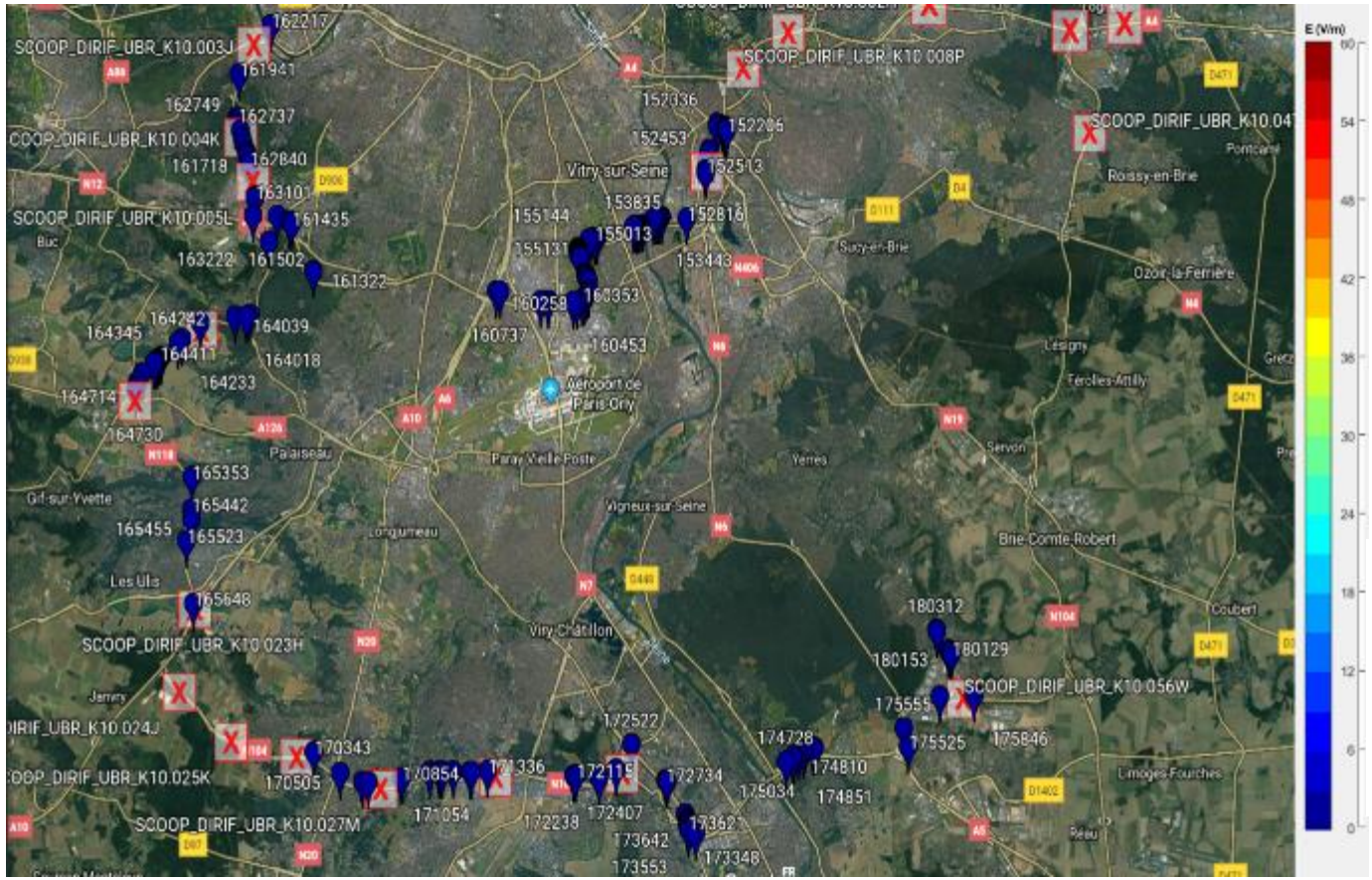
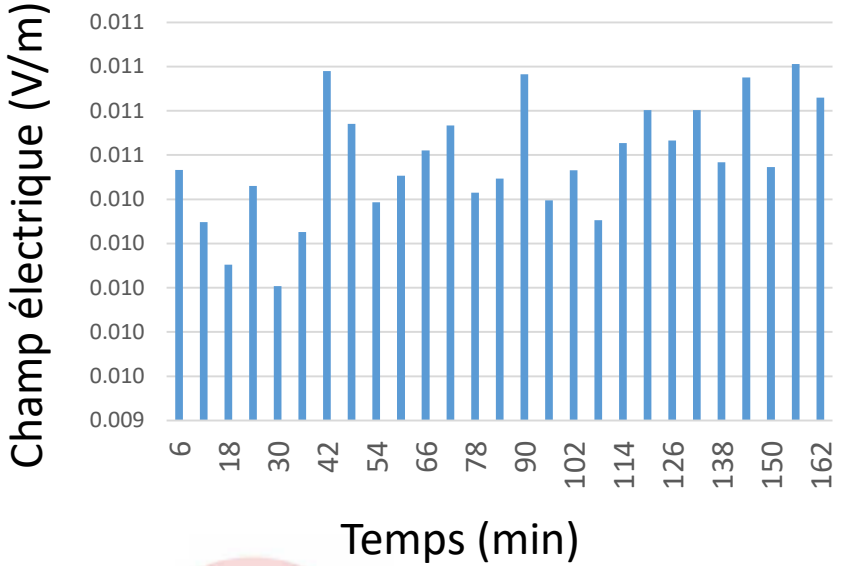
Results in field level with respect to the threshold of 61 V/m recommended by ICNIRP (Roads A86 et N104)





- Maximum value of electric field:

0,011 V/m

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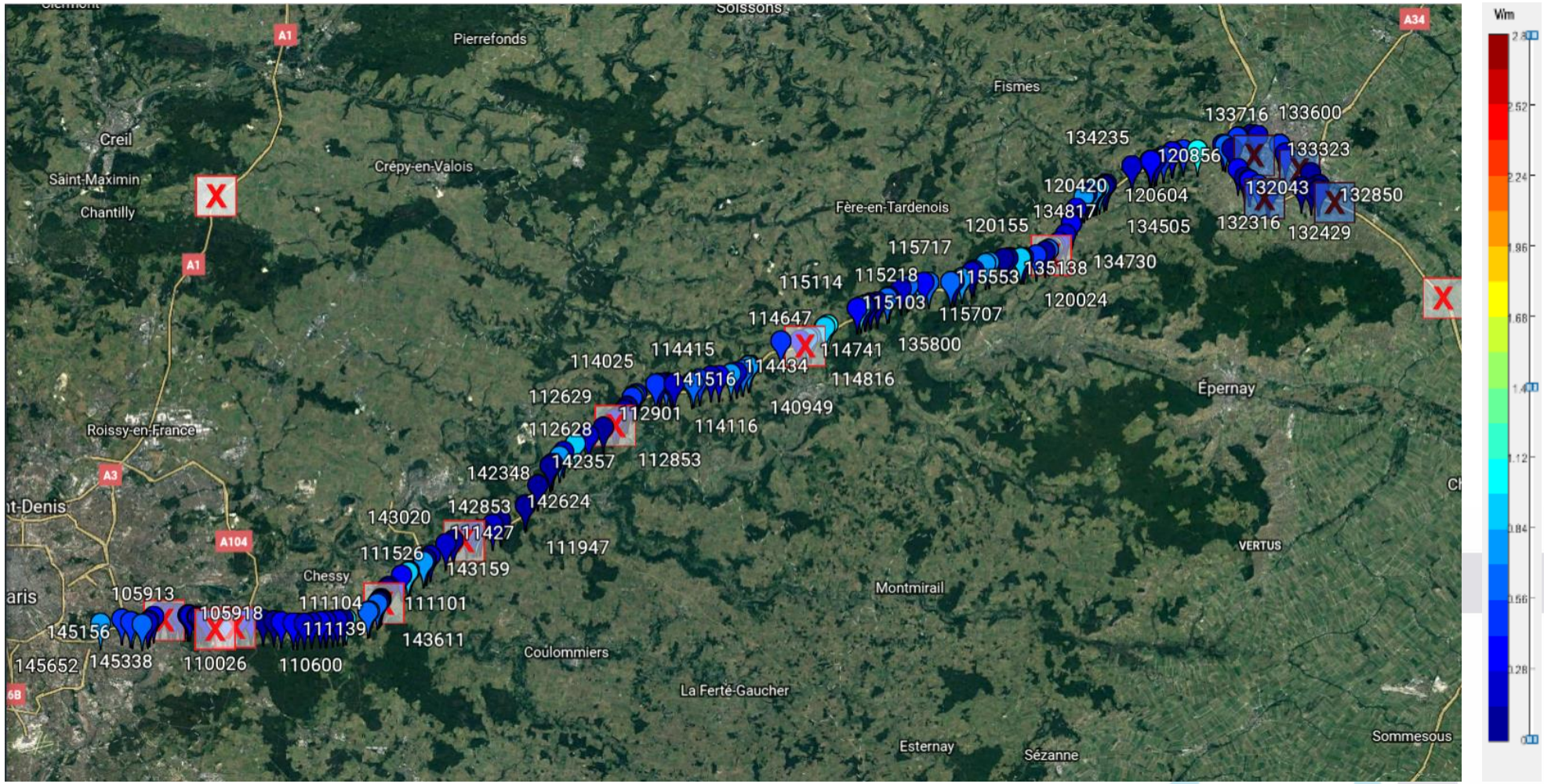
Results – Maximum instantaneous electric field (A4 Paris - Reims)



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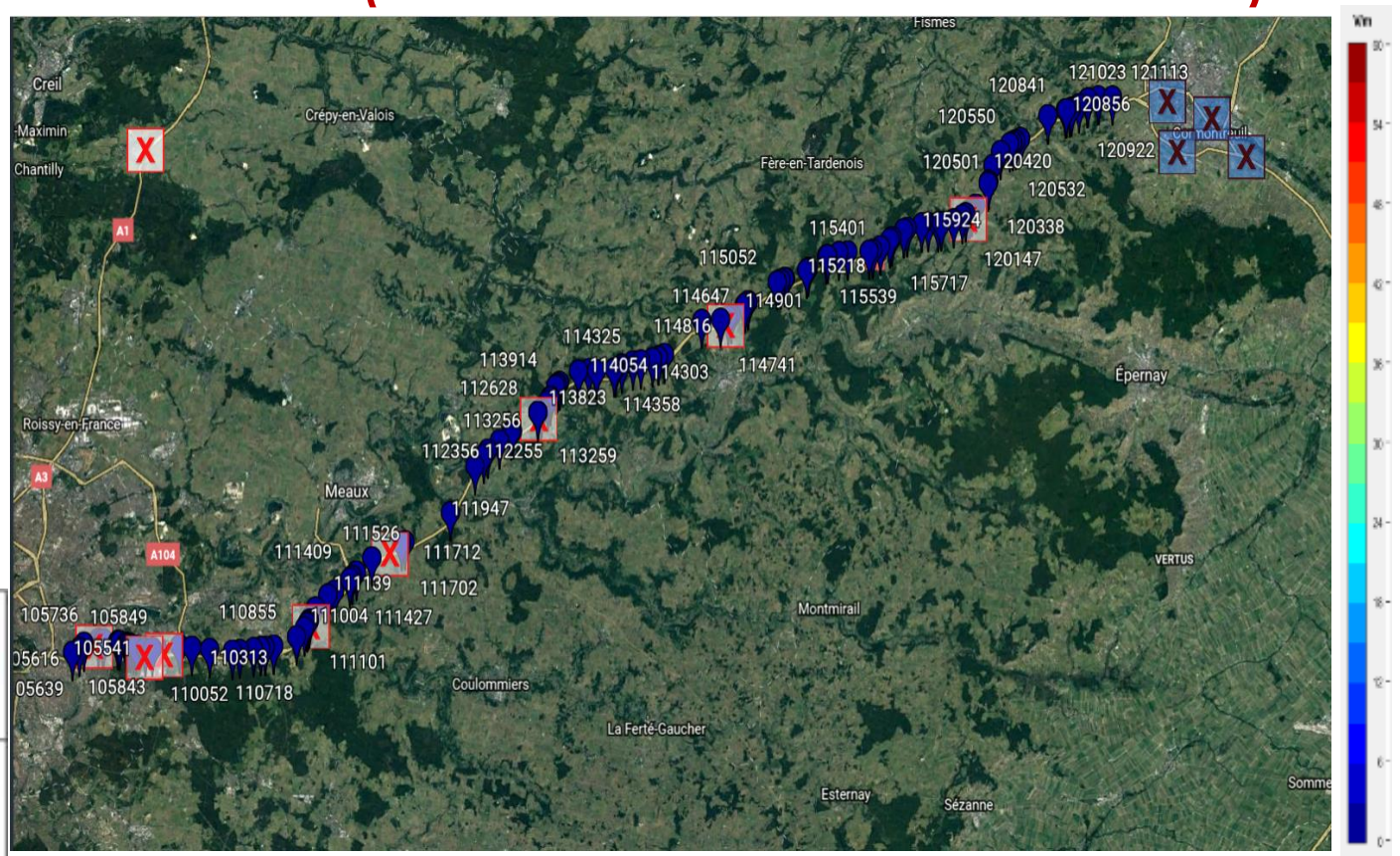
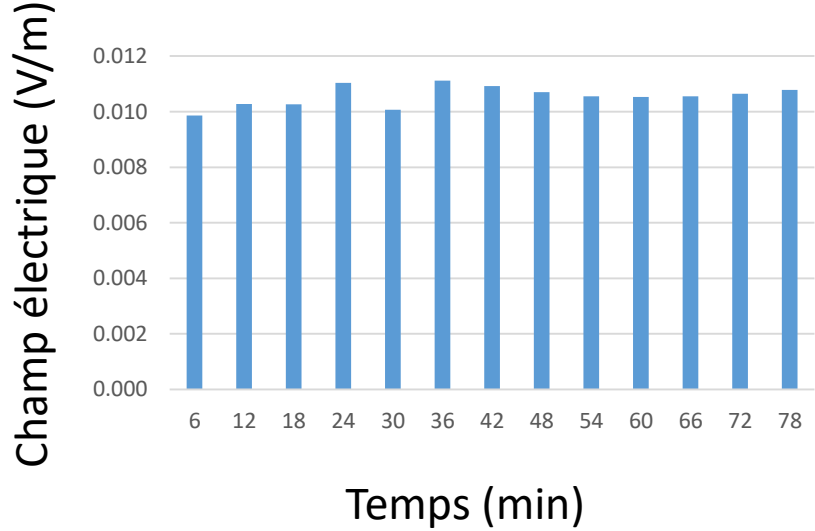
Results in field level with respect to the threshold of 61 V/m recommended by ICNIRP (Roads A4 Paris-Reims)





- Maximum value of electric field:

0,011 V/m

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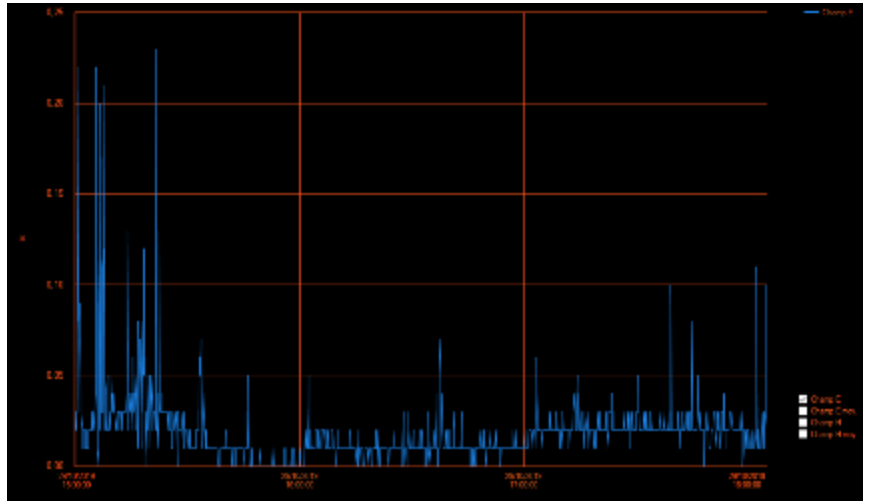
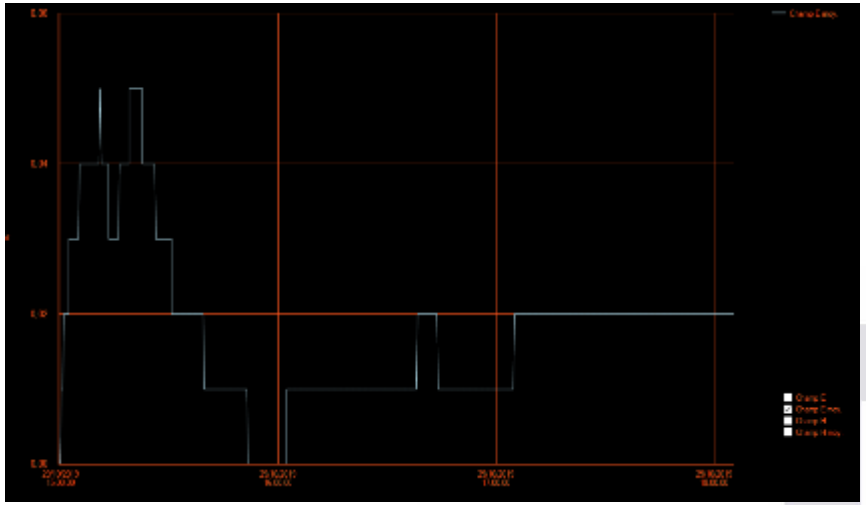
Cumulative assessment (from 100 kHz to 8 GHz) inside vehicle

- Use of an exposimeter (WaveMon) during assessments on A86, N104





- Max. value of instantaneous E-field: 0,24 V/m
- Max value of E-Field(ICNIRP) : 0,05 V/m

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Conclusion

- The general regulatory framework for limiting exposure level to EM fields applies to the Scoop project
  - Limiting the exposure level to 61 V/m for the general population
- The emission level of the wireless system deployed in the their integration constraints, the exposure levels are *a priori:*
  - Much less than the limits prescribed by the recommadation 1999/519/CE of the European council
  - The max. values measured are 0,011 V/m pour assessments along A86, N104 and A4 with maximum instataneous values of 1,5 V/m

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Thank you for listening

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Acceptability study

C. Barbier, A. Koustanaï & L. Guyonvarc'h

Laboratory of Accidentology, Biomechanics and driver Behavior, Renault-PSA

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50 LAB

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Scope

- Methodology development
  - Studying acceptability of a "discrete" system
  - Making a device for self-confrontations without video recordings

  What we tried? What worked?

- SCOOP acceptability
  - How current C-ITS are used?
  - Which ways to re-design the system?

  What we learned? What we recommend?

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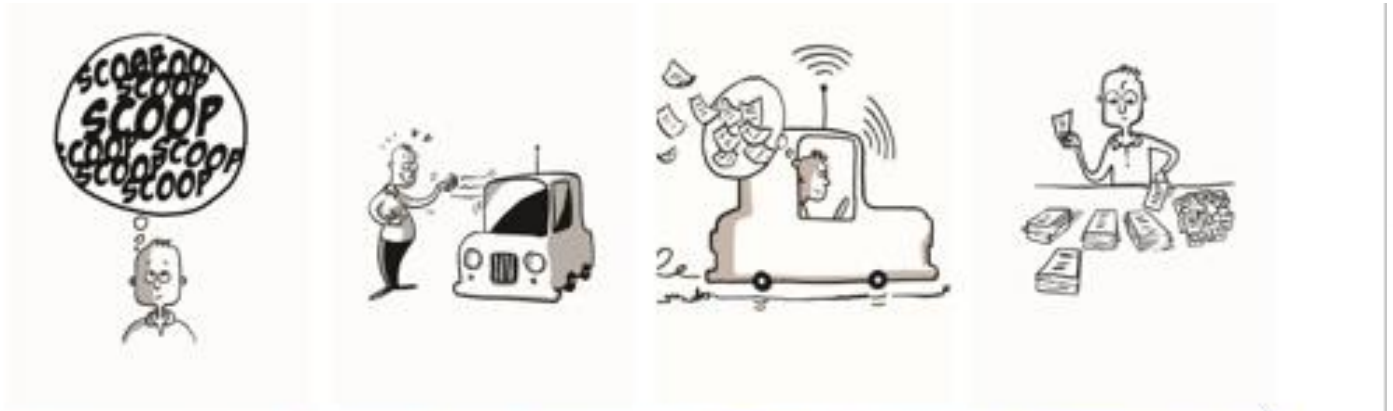
Acceptability definition

- Nielsen: many dimensions of acceptability
- Focus on use of the system over time
- Exploratory and untested way of thinking



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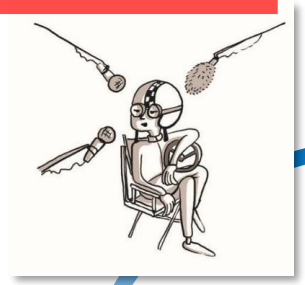
Multi-approach protocol

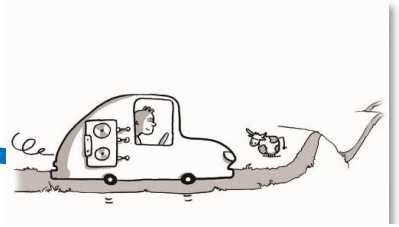
NDS	Ecology ++
FOT	System exposition Ecology +
UX Experts	Each steps of acceptability
Experts Traffic	Objective assets
Focus Co-conception	Leverage of acceptability

Expectations
First-experience
Bounded experience
Reconsidered experience



Experimentation in-the-use with Experts

Expectations



Naturalistic Driving Study
Paris/Britany
15*9 mounths

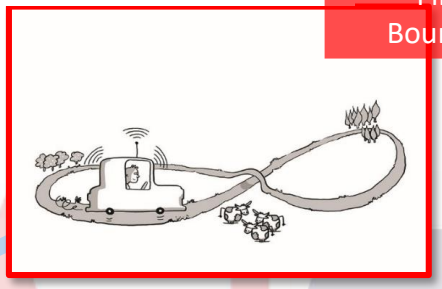
Interview of traffic manager

(Sensibilisation, objective assets)

Focus Group

Reconsidered experience

Expectations
First-experience
Bounded experience



Field Operational Test Bordeaux
29*1 weeks

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FOT in Bordeaux

Meeting, vehicule presentation	Usual driving on Bordeaux ring road + instruction for live vocal recording	Post-hoc interview

Friday	Saturday	Sunday	Monday	Tuesday	Wenesday	Thursday	Friday

]Expectations]

] First-experience [

[Proto-exp. Bounded[

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Collecting tracks for self-confrontation without video

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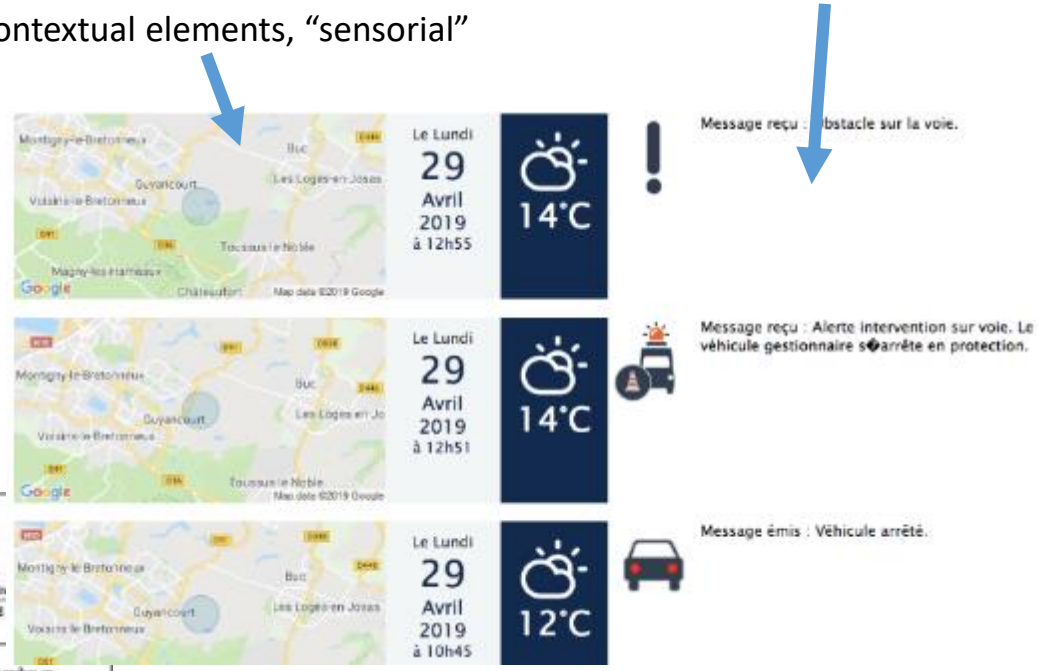
Reproduction of SCOOP message

Contextual elements, “sensorial”



Intelligent logbook

Integrated voice recorder

- Ethics
- Aggregation of contextual user experience tracks
- Risks and cautions
  - unuse/misuse of the vocal recorder
  - Lack of immersion with the logbook

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NDS
FOT
(Experts)

Expectations

- SCOOP is seen as an "improved WAZE"
  - Navigation expectations (routing, traffic facilitations, time schedule)
  - C2I often misunderstood
  - NDS: seen as a tutorial system
- Current use of C-ITS
  - Annoyance in every systems/combined uses > "unlocked" pairing between driver and device
  - Valuable comfort provided by messages integration into the navigation screen
  - Error tolerance (visibility of SCOOP's improved reliability?)
- Low/unspecified expectations: towards a "pop-culture" where a priori expectations remain open (nor negatives or positives)

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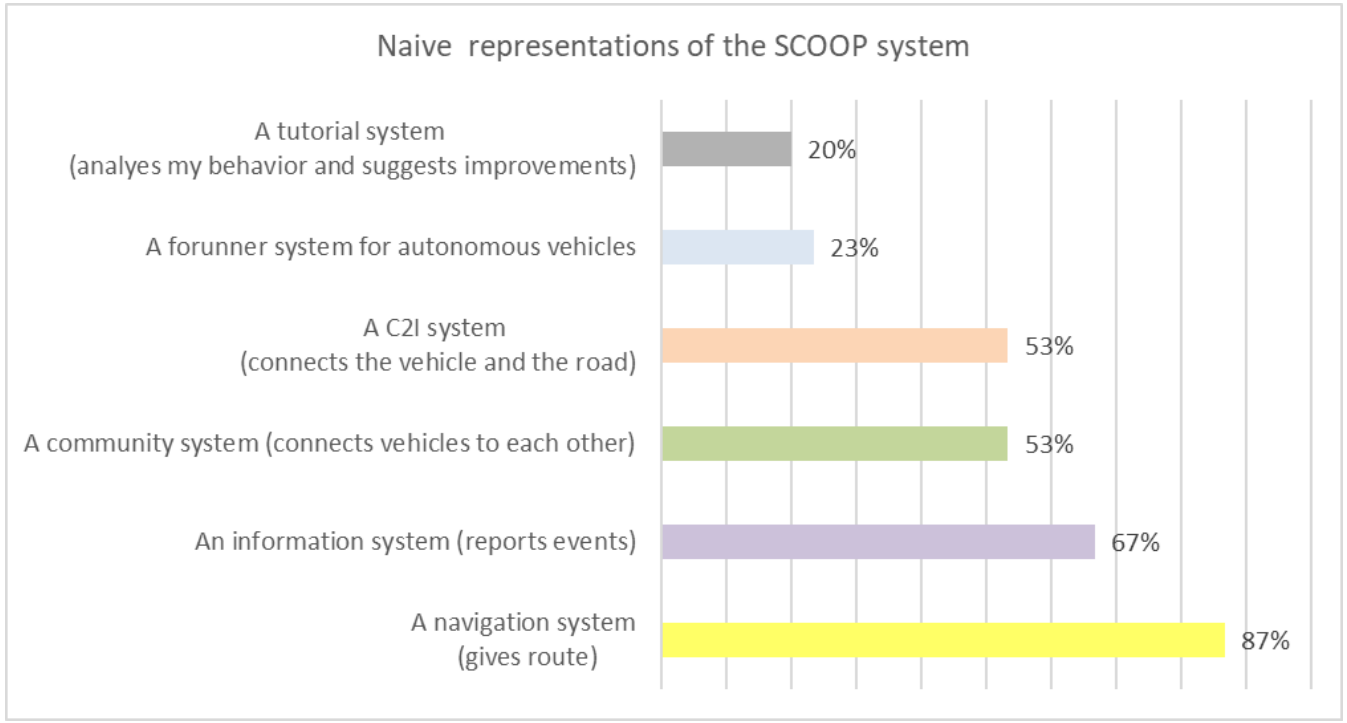
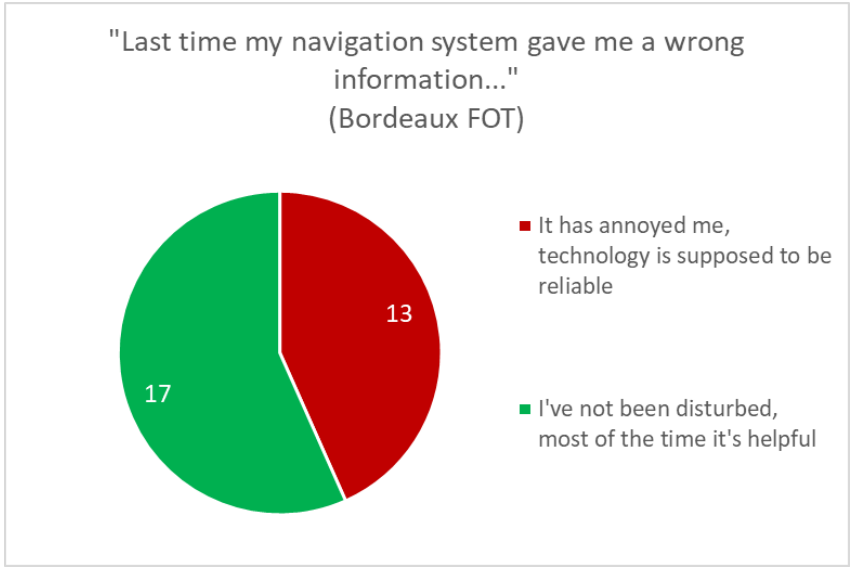
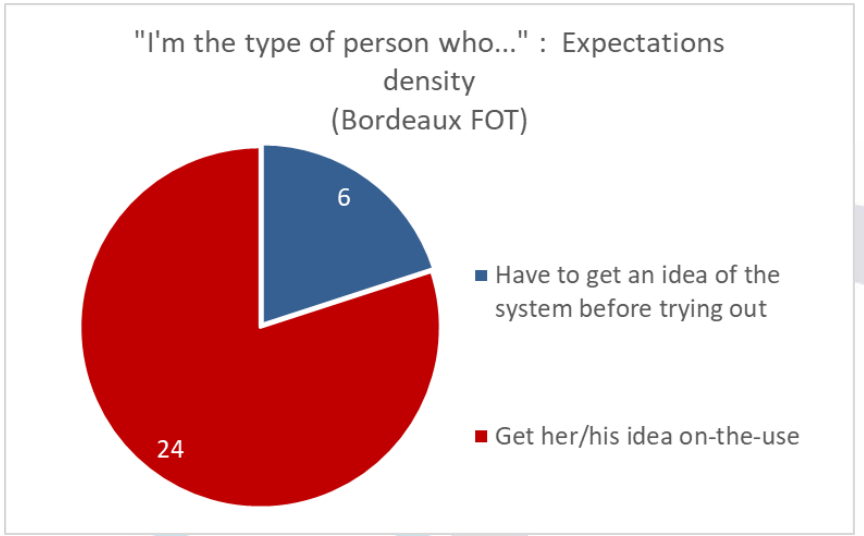
Expectations







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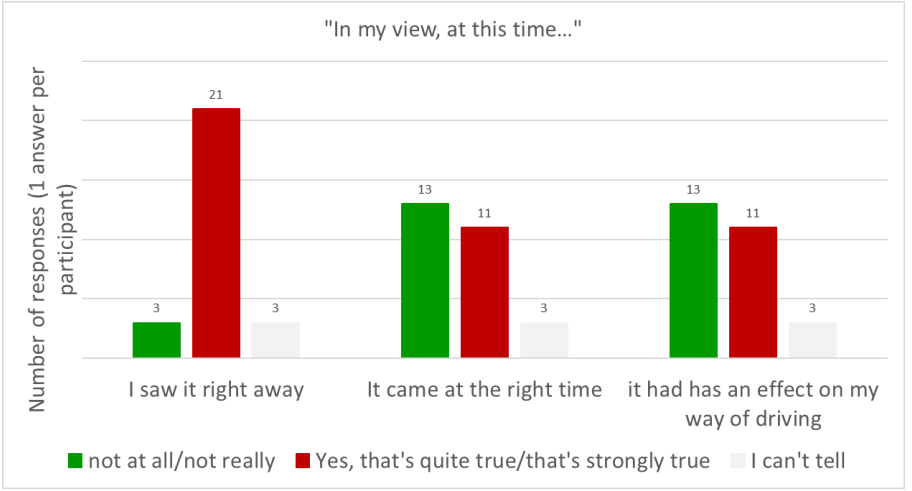
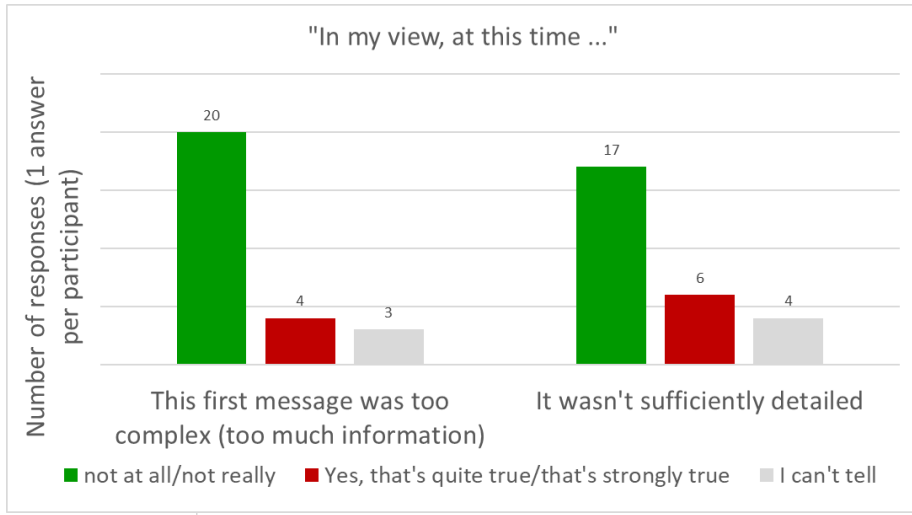
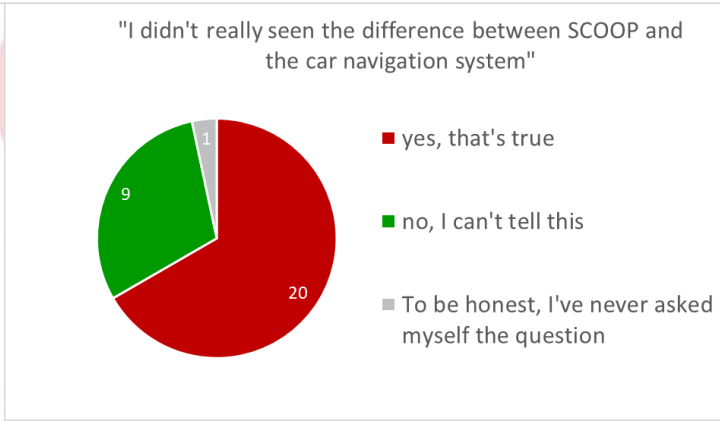
First-experience

(NDS)
FOT
(Experts)

- When handling the system: utility salience
  - Missing UC to report: Traffic jam and risk area
  - False-negative complain in comparison with WAZE
- Quite acceptable usability but might need to be improved
  - Good usability despite some confusions
  - To be improved: "design", feedback when a message is sent, some titles should be more explicit
  - Reliability rating not always seen/understood
  - Icons setting on the map > desire to click to open ahead the pop-up
- Misunderstanding about SCOOP's functions
  - False positive attributions
  - Navigation functions
  - Expectations about taking into account events in the current route







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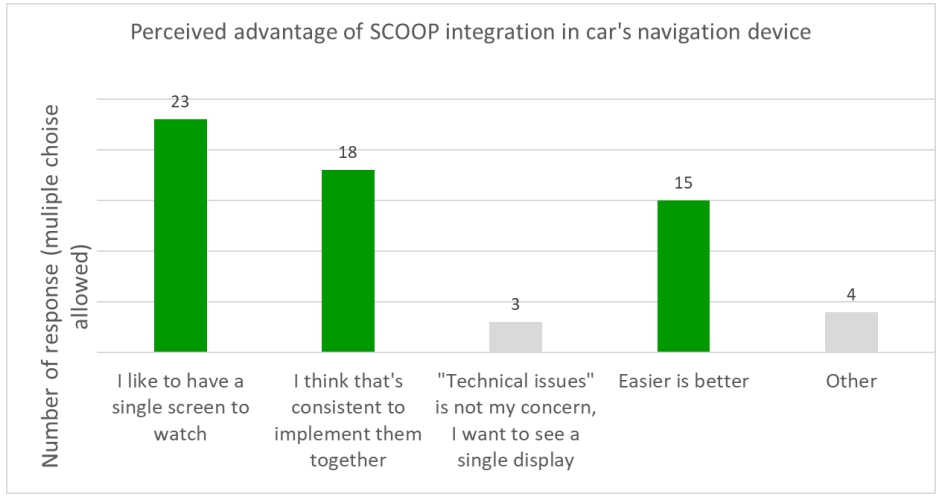
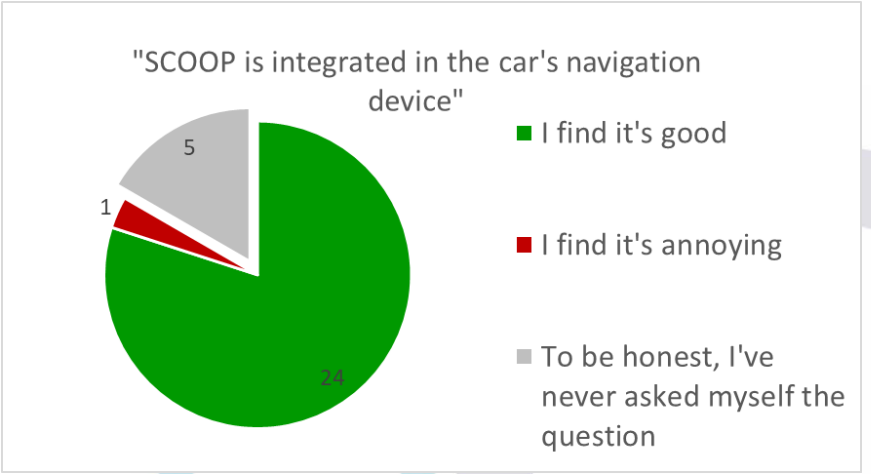
Bounded experience

FOT Experts

- Usability in-the-use
  - Display zone: map/driver axis?
  - Audible modality required, especially speech recognition
  - Navigation/SCOOP consistency required
  - False-positive better accepted than false-negative
- Utility in-the-use
  - Advantage provided by warnings for re-routing (for strategic and tactic purpose)
  - Limited interest for some UC, whereas some UC are missing
  - C2C
    - Automatic sending is not convincing
    - Manual C2C: semantic filter
    - C2I underutilised





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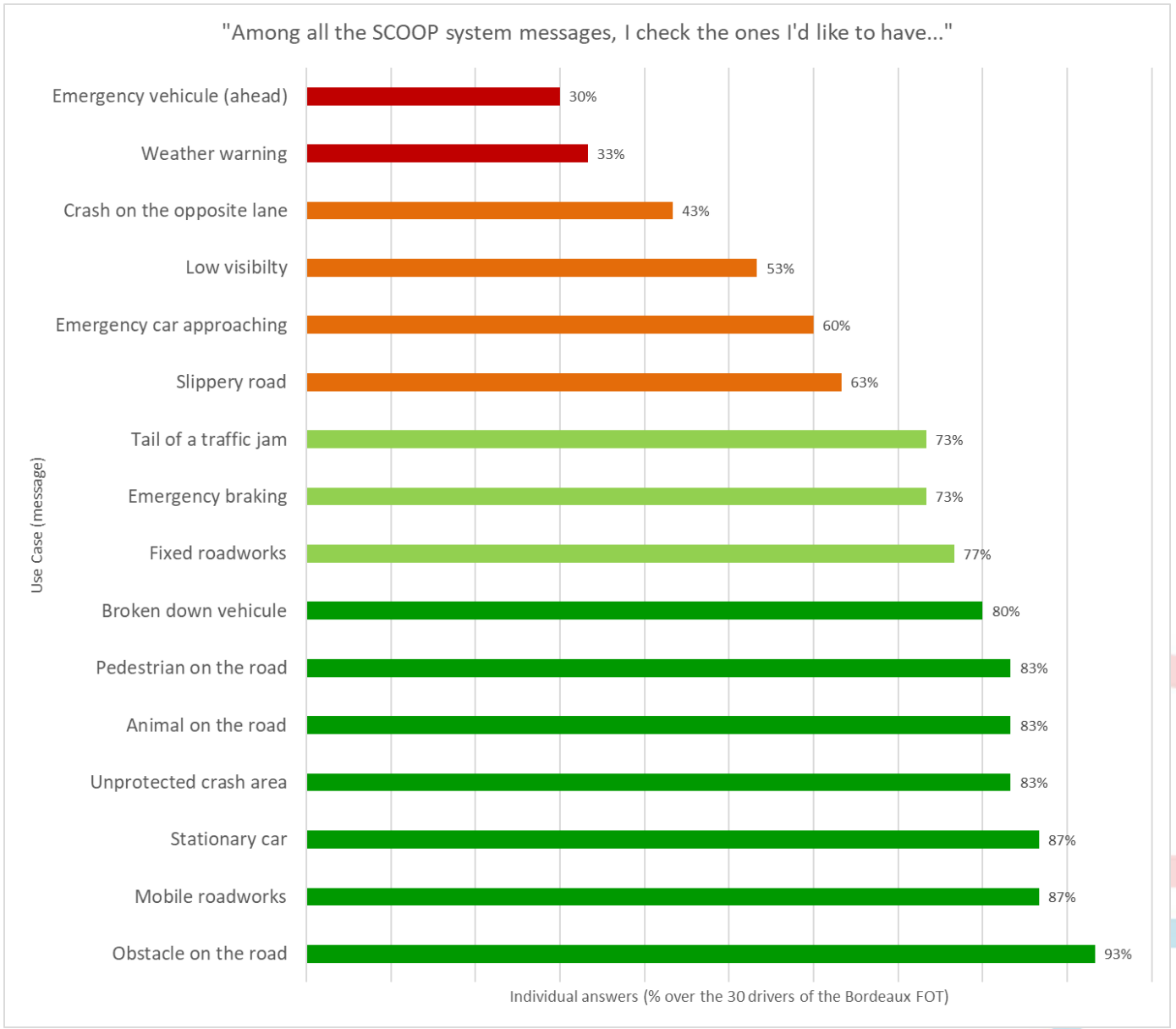

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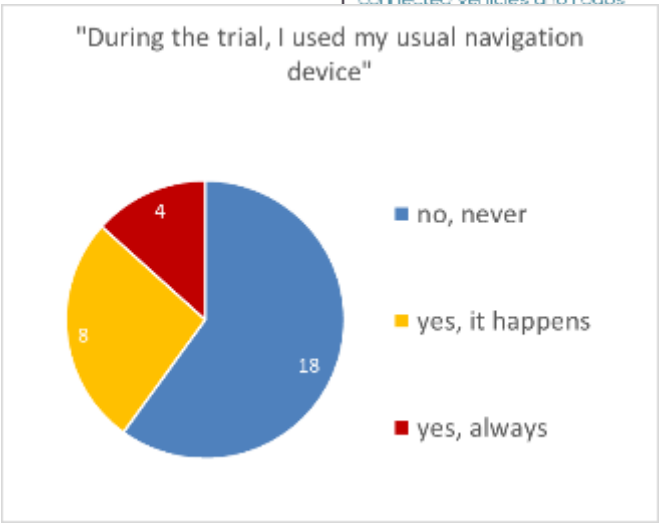
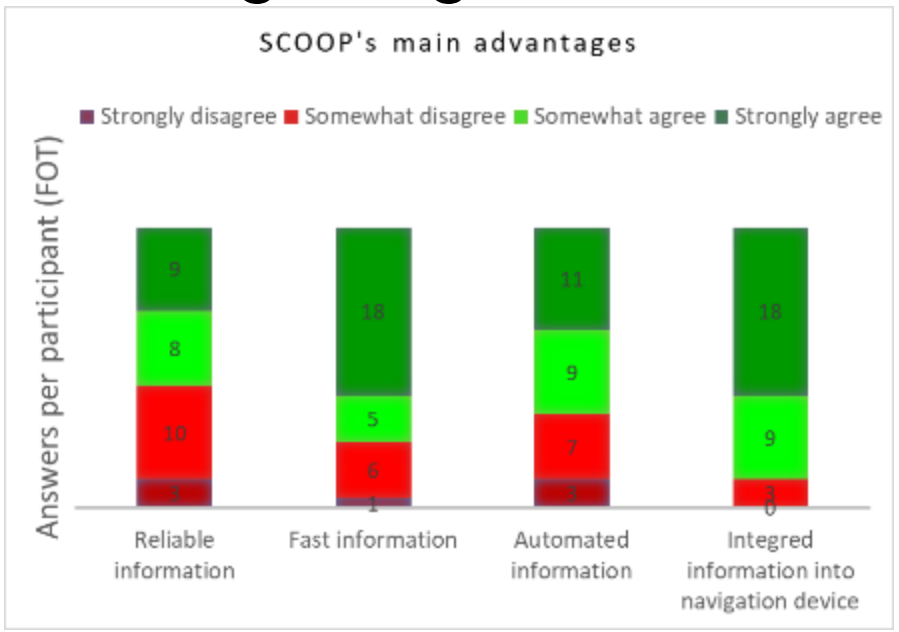
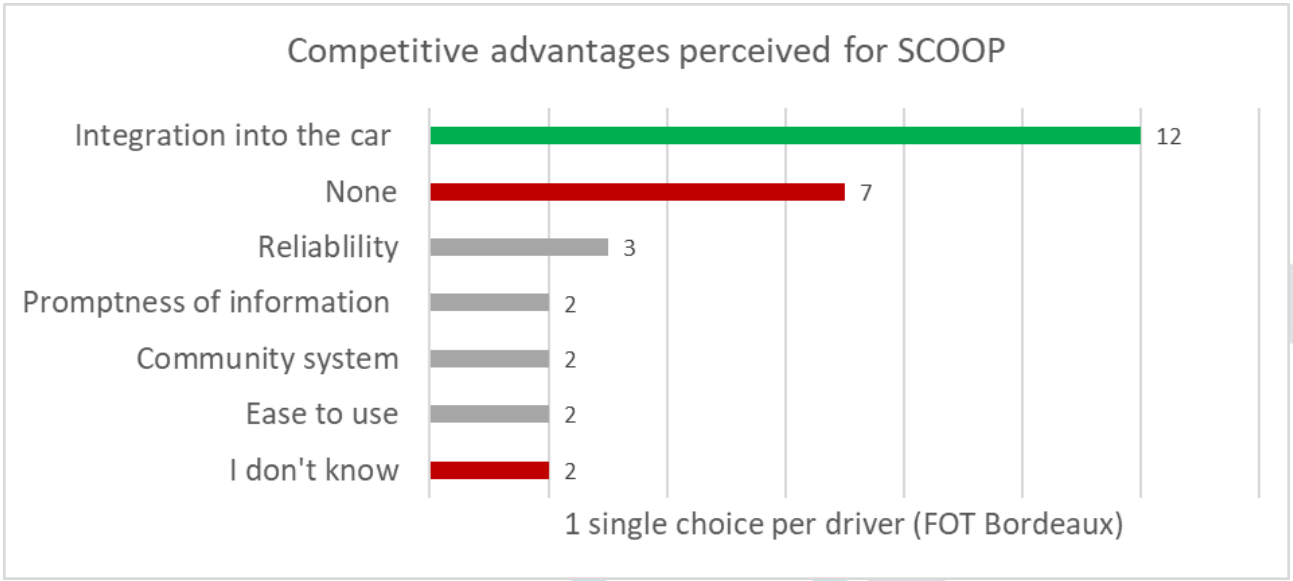
Reconsidered experience

Focus FOT (FOT) Experts

- Usual C-ITS used during test week
  - Limitation by lack of navigational functions
- Competitive advantage hardly perceived
- Adding navigation functions needed?







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Wrap-up

- High points
  - Potentially acceptable system
  - Advantage from integration into the vehicle (information consistency and large screen)
- Aspects to work on
  - For now, limited expectations from information reliability (accuracy, real-time) in comparison with existing systems
  - SCOOP is perceived as an integrated navigation device
  - C2I saliency / benefit provided by a holistic view
- Enhancements
  - Reporting traffic jam and risk areas
  - Relevance of information associated with messages (reliability rating, speed recommendation)?

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Recommendations

- Better communication on SCOOP's safety purpose / added-value
- Work on UC with users
  - Co-design
- Optimising the HMI
  - strategy, displays, feedbacks
- Full integration into car navigation device
  - Informational consistency, impact on current route
- Combining with other services/navigation or safety functions?
  - ADAS, tutorial, connection with other services, new functions

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Results of the two organizational impact studies

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Study 2 : Mehdi Chahir, Université Rennes 2/CEREMA/DIR Ouest, mehdi.chahir@i-carre.net
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Common problematic

- Ownership of a technological innovation is neither automatic nor systemic (Andréani, 2001 ; Jorgensen, 2014).
- The implementation of a new technical system has an impact on: tasks, skills, management, organization ... (Bobillier-Chaumon, 2013, Brangier, 2010, Valléry, 2003).
- Starting point: understand how professionals work and communicate without this new system.

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Common theoretical basis

- To understand how professionals work, it is essential to distinguish between what needs to be done, the purpose (task) and what is really to accomplish this task (activity) (Leplat, 1986).

Task	• Goal that is set • Conditions in which it should be achieved
Activity	• What is undertaken by the subject to accomplish the task

Importance of

- Analysing the **real behaviour** of operators.
- Understanding how the activity is constructed by a given operator in a **given context.**

- The operator is not only the 'human factor' but a 'human actor' (Weill-Fassina et al. 1993).
- For one task, they are a lot of different activities.

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Two complementary studies on three fields of study: 3 pilot DIRs

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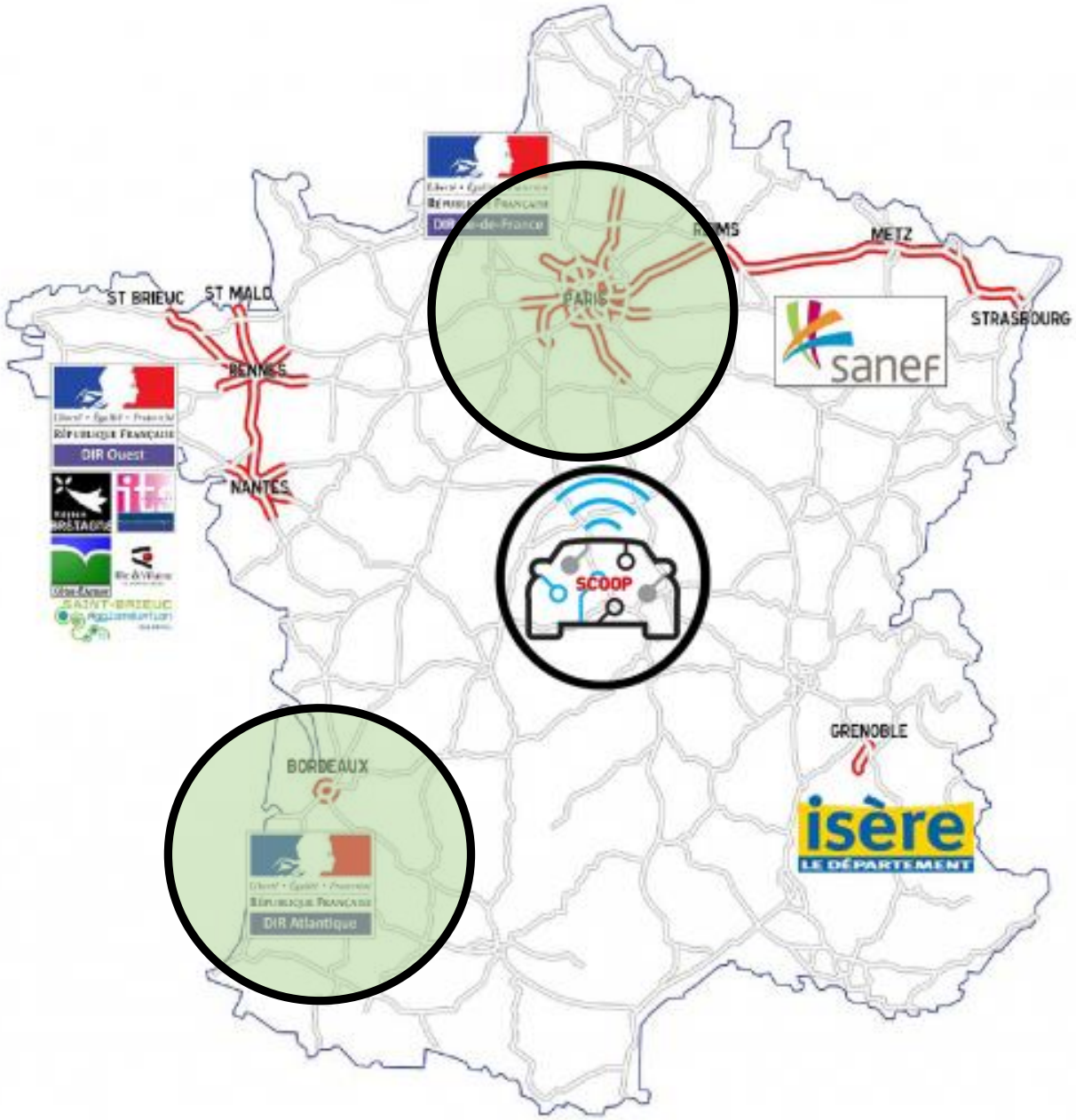
Study 1 :
DIR Ile-de-France & DIR Atlantique



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Method

Phase 0
- State of art + SCOOP system understanding
- Questionnaires administered to pilot sites managers
- Interviews with pilot sites managers

Phase 1
- Ex-ante
  - a. Field workers: observations + verbalizations
  - b. Traffic supervisor: observations + verbalizations.

Phase 2
- During implementation: participation as observer and recommendations

Phase 3
- Ex-post
  - a. Field workers: observations + verbalizations
  - b Traffic supervisor: observations + verbalizations.

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Method

- Who?
  - 6 field workers / 3 intervention managers with different levels of experience
  - 3 traffic supervisor / 1 chief / 2 managers with a long work experience
- What?
  - Various activities in road operation: patrol, intervention, night roadworks (marking)
  - Activity of traffic supervision
- How?
  - Observations
  - Verbalisations

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Results

- For each activity:
  - Identification of the sensitive elements to monitor and of the difficulties to which the system can provide a solution
  - Focus on information circulation
  - Proposition of recommendations

For example: take into account the diversity of the local functioning during the conception of the system -> Introducing flexibility.

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Results: advantages of SCOOP

For intervention	For traffic supervision
• Less administrative tasks • More security/efficiency because of the information given to road user • More precise location of an event to facilitate the intervention	• Better information to users: precise (geolocation), real-time (without a need to call at the beginning and at the end of an event) • Automation of a part of the log book filling

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Results: key issues of SCOOP

For intervention	For traffic supervision
• Anticipation of field problems (ie. no geolocation in tunnels) • Automation of the system during the access to an event (driving task) • Taking into account managers tasks • Keep direct communication with phone	• Associate the operator to define what need to be automated • Interfaced the different tools • Think about the organisation of the work between road police and operators

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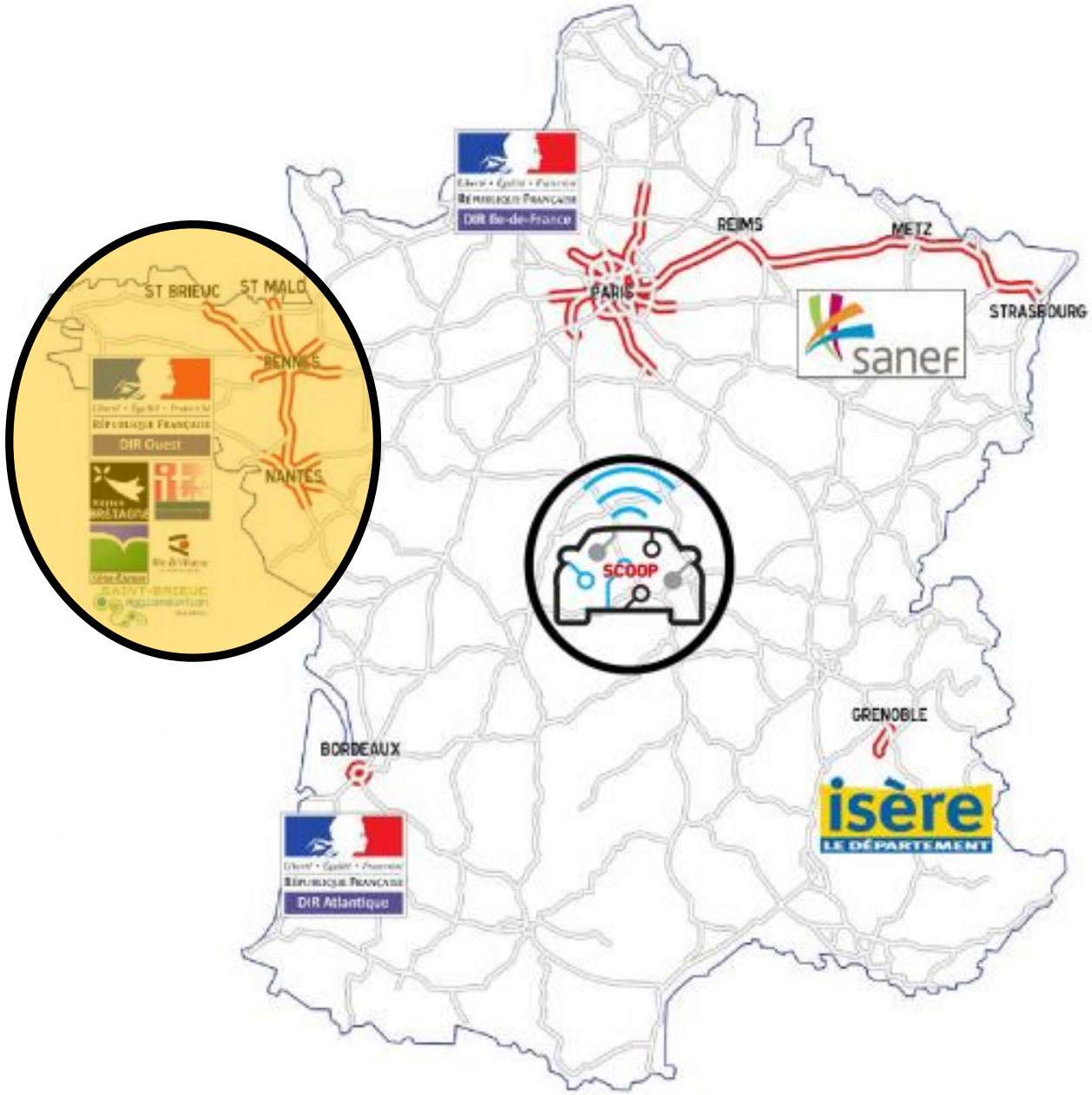
Study 2 : DIR Ouest



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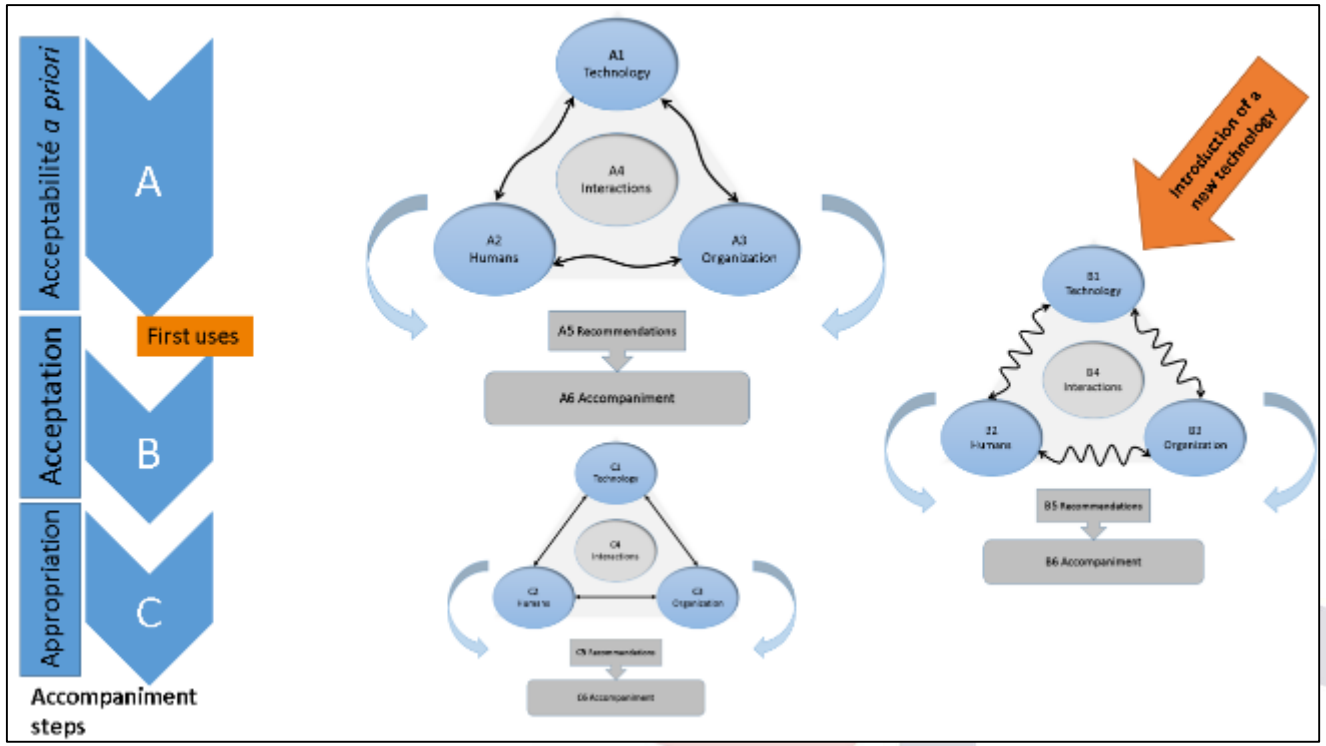
The accompaniment process

- **Objective:** Successful deployment by creating a favorable context for C-ITS

- **Methodology before, during and after deployment:** studies at three levels (individual, technological and organizational), their interactions (to anticipate changes), recommendations and support on these three levels

- **Philosophy:** taking into account the expertise of all actors, respect and consideration



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Studies and methods used

- **Study of the impacts of C-ITS on the organization of the West DIR**
- Interviews with all department heads (N = 14)
- **Study of the impacts of C-ITS on CIGT's operations and operator's professions**
- Analysis of the activity (observations, interviews, N = 17), focus-group (N = 23), questionnaires (N = 34)
- **Impact study of C-ITS on network administration and equipment maintenance**
- Interviews with officials and agents (N = 7)
- **Evaluation of the impact of the approach before deployment**
- Questionnaires DIRO, DIRIF, DIRA (N = 390)

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Overall results of these four studies

1. **What impact on the organization and the professions?**
2. **What reception from the agents?**
3. **What are the contributions of the approach?**

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What impact on the organization? (1/2)

- The deployment of C-ITS re-questions the organization of road managers.
- At the DIR Ouest, the services carry out many actions (= 69). A significant proportion of these actions **(= 47, ~ 68%) have been or will be re-examined and / or modified**. Eight themes:

Dynamic equipment	Embedded systems	C-ITS data	Skills management
Career Management	Procedures and training	Road information	User relationship

In total: 38 recommendations proposed to DIT and DIRO

•Example: the C-ITS allow a direct link with the users which can lead to an evolution of the relationship between the road managers and the users.
Strengthening the proximity and sense of public service.

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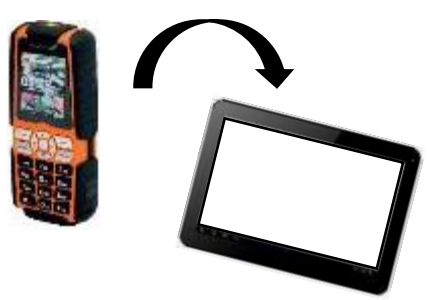
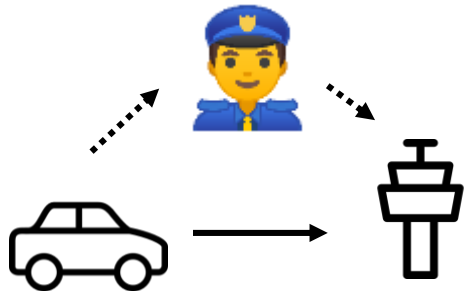
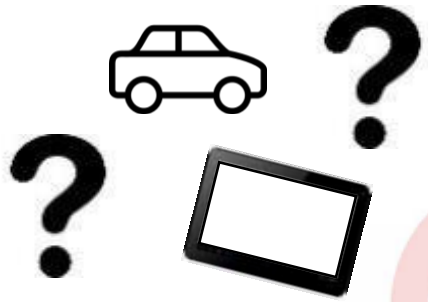
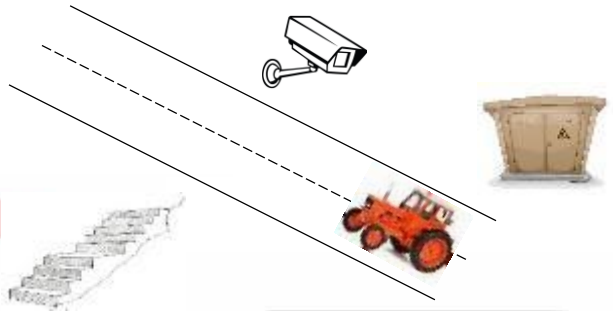
What impact on the organization? (1/2)

- The roll-out of C-ITS reinterrogates all the trades of road managers. Four highly impacted trades.

Some illustrations:

Operating agents	CIGT Operators	System Administrators and Networks	Equipment maintainers trackside
			
Study the complementarity between the tools	Ensuring the transmission of information	Reflect on creating new relationships	Anticipate the installation of equipment
In total: 26 recommendations DIT and DIRO + Co-construction of new practices		In total: 18 recommendations DIT and DIRO	

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What reception from the agents? (1/2)

- **Accordance between project goals and representation of the agents toward their profession**

- **Questions about the added value of the project**

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What reception from the agents? (2/2)

- **Concerns about ergonomics and technical operation versus field constraints**

  - Improvement of embedded use
  - Creating a connected van
  - Creation of a unique tool to help with traffic management
  - Integration of tools developed to manage administration and maintenance

- **Fears related to the drift of geolocation**

  - CNIL: possibility to disable Scoop
  - PKI: protection of personal data
  - Communication on the measures implemented and show the agents that their opinion is taken into account!

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Evaluation of the contributions of the accompaniment

- The agents who directly participated in the process:

✓Have a better knowledge of the Scoop project and the C-ITS

✓Feel more in ability to use them

✓Feel more taken into account by their hierarchy

✓Have more confidence in the help they can receive

✓Are much more positive about the deployment process

✓Much More Intent to Use C-ITS

✓More likely to recommend the use of C-ITS

- Professionals who were on a site that benefited from the approach are more favorable to the deployment of these new technologies compared to professionals from other pilot sites.

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Feedback: the main principles to remember from the approach

Two main principles to remember

Take into account the real work

Raise awareness and train the hierarchy

10 actions for successful deployment

- Involve the hierarchy to carry C-ITS
- Create a multidisciplinary project team
- Meet with the unions
- Communicate throughout the organization
- Communicating directly with the agents concerned
- Create or strengthen relationships with external partners
- Integrate C-ITS in the current operation: associate teams, improve working conditions, train teams, monitor changes induced by C-ITS

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Thanks for your attention !

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- Alain Somat, Université Rennes 2, alain.somat@univ-rennes2.fr

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connected vehicles and roads

Legal aspects

Legal Responsibilities

Protection of users' personal data

Michèle GUILBOT

IFSTTAR - Department TS2 / MA Laboratory

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Objectives of the action on legal aspects

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Role of IFSTTAR

support to public authorities (MTES/ DGITM)

legal impacts of project SCOOP / C-ITS

- on the personal data and privacy of users
- on liability in the event of accidents: what legal framework?

Among the objectives to be pursued in C-ITS	**Ensure the safety of users of connected vehicles, in particular by preventing intrusions into the system in order to** - **avoid malicious control of a system element** - **avoid the collection and illegitimate use of data (personal or not)** - **and finally to avoid the occurrence of an accident and/or the violation of personal data**

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Protection of users' personal data

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This must be one of the objectives of C-ITS	Contribute to the deployment of a connected road traffic system in compliance with legislation on the protection of users' personal data and privacy to ensure that their rights are respected, including their fundamental rights

Main SCOOP documents to consult

- Guilbot M. & al. presentation file of the SCOOP project at the CNIL, July 2016
- Ollinger E., Esposito MC & al. Complementary document for the CNIL, December 2016
- Letter from the President of the CNIL to DGITM, 18 July 2017
- Guilbot M. Synthesis on the protection of personal data in SCOOP, July 2019

RGPD - Data Protection Act amended - Decree 2019

Among the **principles**: *accountability*, compliance from the design stage and by default, data minimization // Cybersecurity

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Responsibilities
Framing of the study

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I. - Theoretical analysis

- The regimes of mobilizable responsibilities
  - Compensation for accident victims
  - Sanctioning misconduct
- The responsibility of agents and their functional protection
- The responsibility of the administration towards its agents
  - vehicle geolocation, risks related to distraction or overwork, *impact of waves on health*

Focus of the study on the responsibilities of the administration and its agents

II - Case law illustrations

- Analysis of the criteria
  - administrative liability for *failure to carry out normal maintenance*
  - criminal liability of natural persons

A major difficulty: a largely prospective field of investigation

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Responsibilities

Tools" needed for analysis

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Legal texts

Published texts (responsibilities, road management, signage, etc.)

+ if possible, any circular / instruction produced by the State services or partners, directly or indirectly applicable to TSI-Cs

Ex.
- technical note on road information for users on the National road network (14 April 2016, DGITM / *BO*)
- instructions to subcontractors, public procurement CCAP and CCTP DiRIF, 2015

Jurisprudence

- Administrative liability *(published case law)*
- Criminal liability
  - published case law + previous INRETS work on DDE litigation
  - litigation files made available by managers or the State? *finally not retained: files not available for consultation*

Some SCOOP deliverables

- management of displays on UEVg HMIs
- system acceptability by operating agents
- service description
- studies on distraction
- security (*cyber*) studies...

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Responsibilities
Context elements

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- C-ITS, operational elements necessary for analysis
  - technical elements that may be taken into account by a judge in a dispute
    - messages, equipment, security systems,...
- European legal context for the deployment of ITS
  - reminder of specific legislation
    - EU law
    - national law conformity with Community legislation
  - interests of this reminder
    - position SCOOP in the European legal context of C-ITS
    - check the legal status of C-ITS
      - e. g. *a priori* no reference to the concepts of public service or general interest
- Positioning of safety requirements systems
  - products / services under common law
  - specificities for automated / connected systems?
  - specificities for C-ITS?

Demonstrate the robustness of the measures taken to ensure the security and reliability of systems, including cybersecurity,
or
improve the system

Do not overlook the impact of standardization on responsibilities

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Responsibilities **General information**

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- Legal responsibilities
  - personal injury or death to persons
  - violations of the rights of drivers involved in SCOOP and, more broadly, in C-ITS
- The aims of the project
  - Compensation of victims
    - Civil liability
    - Administrative responsibility
  - Criminal liability
- Persons likely to be involved in a liability mechanism
  - The legal categories of the persons concerned

Mapping the actors, the status and role of each one. Check the contractual clauses,....

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Compensation of victims

Diversity of complex procedural regimes

- study focused on the **responsibility of the administration and its agents...**
- ... but sometimes it is difficult to reason without taking into account the general context, in particular
  - liability of the driver or guardian of the vehicle
    - obligation to compensate them (covered by *insurance or guarantee fund*)
    - but the final contribution to the debt can be attributed to other actors
  - liability of partners or subcontractors
    - liability of a manufacturer in the sense of liability for defective products
    - and/or possible mobilisation of common law regimes (contractual / tortious)

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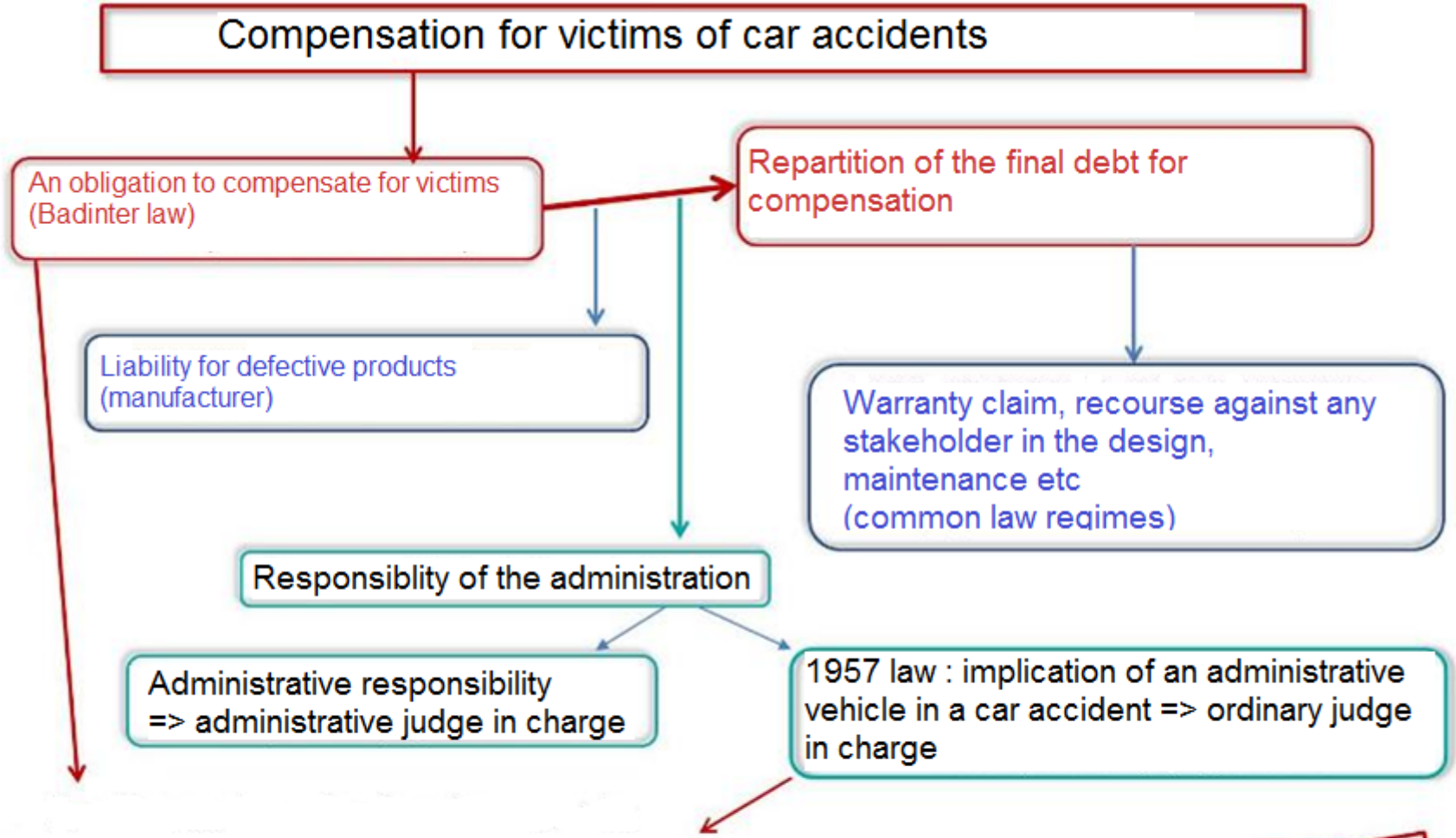
Responsibilities



- based on the implication of the vehicle
- in charge of the driver or guardian of the vehicle (their insurance)

without any reference to a fault

- connected and communicating vehicle : implication without contact

+ Role of insurances

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Responsibility of the administration and its agents

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Administrative responsibility lack of normal maintenance (?)
Criminal liability of the agent normal due diligence (?)

- Management of potential risk
  - predictability / unpredictability of risk for the administration
  - "distance" / "delay" between the information delivered and the event
  - response times by operating officers
- Information provided to the user
  - **Prioritisation of** information
  - **Dissemination of** information: why was it not transmitted? at what stage?
  - **Quality of** information: sufficient, appropriate / consistent with regulatory signage
  - **Readability of the** information: understanding by the user / contradiction with another source
  - Consequences of the information on the user's behaviour

Case law criteria analysed

Responsibilities related to IT security and data protection

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Responsibility of the administration

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- search for the basis "lack of normal maintenance" (?)
  - search for criteria to apply this basis to SCOOP / C-ITS

↓

- in order to determine whether this regime is applicable, are studied
  - the involvement of the vehicle and the nature of the involvement
    - private vehicle / public service mission
    - administrative vehicle or similar
  - the qualification of equipment specific to SCOOP / C-ITS
    - fixed stations (UBR)
    - IT architectures

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Responsibility of the administration

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– The involvement of a SCOOP vehicle
  - contactless involvement by providing information(s)

- The impact of the involvement of an administrative vehicle equipped with SCOOP on jurisdictional competence
  - with regard to the quality of the victim
    - public official or not
  - by considering the nature of the operative event attributable to the involvement of the vehicle
    - made of traffic or made of exploitation?

*We retain the **fact of exploitation** => competence of the administrative judge*

→ Search for the basis of the action

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Responsibility of the administration

- Qualification of SCOOP-specific "road" equipment
  - public work or not? exceptionally dangerous public work?
  - as it stands, no directly applicable case law

  → analysis of the case law on the lack of normal maintenance + particular attention to that concerning
    - power generation facilities
    - automatic signalling

- Illustration: fixed stations (RSU)
  - considering the qualification criteria for a public work
  - and their application to the different elements of the system
    - tangible / intangible (IT architecture)

*We propose the **qualification of public works**, without retaining the nature of exceptionally dangerous works*
→ *application of the theory of the defect of normal maintenance*

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Responsibility of the administration

The "lack of normal maintenance"

- Lack of normal maintenance, operation
  - user must prove the causal link between the defect and the damage
  - user is opposed by the predictability of the risk for a normally attentive and diligent driver
    - to what extent will this argument be enforceable when the failure is related to an infrastructure connected to the vehicle? to incorrect information transmitted to the vehicle?
  - administration must prove the normality of the interview
- Possible challenges
  - project owner, operator, guardian of the structure,...
  - possible sharing of responsibility
    - including with the driver (*limitation of his compensation*)

Major role of the administrative judge

case law

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Responsibility of the administration

The "lack of normal maintenance"

- which fact attributable to the administration to engage its responsibility?

analysis of the quality of the victim

Quality of the victim	In the absence of the administration
User	Alleged misconduct
Third parties	No fault
Participant	Foul

- analysis of the jurisprudential criteria for transposition to SCOOP/C-ITS
  - risk knowledge; predictability or unpredictability
  - measures implemented
  - response times

2nd part

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Responsibility of the administration

The distribution of the final burden of compensation

Cases where compensation was charged to the administration

– Possible ways forward

- contractual basis links between the administration and its service providers / subcontractors / co-contractors (*public procurement*)
- case of a manufacturer being held liable by the administration on the basis of liability for defective products
- recourse action against the offending agent
  - *in chapter on agent responsibility and functional protection*

no analysis on remedies against legal persons governed by private law

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Responsibility of agents and functional protection

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- Fault of the agent and functional protection
  - criteria for functional protection

– Failure of the agent and administrative case law
  - personal fault / service fault
  - the cumulations
    - misconduct, e. g. personal misconduct of the staff member and misconduct in the organisation of the service
    - liability in the event of personal fault not unrelated to the service

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Responsibility of agents and functional protection

– Illustrations for SCOOP

- personal misconduct unrelated to the service is not considered (*e.g. malicious intent*)
- but could be considered the personal fault committed with the means of the service
  - use of an equipped vehicle outside the service
  - sending incorrect information
  - that would have contributed to creating an accidental situation
- an accumulation of faults could also be considered
  - e. g. distraction or overwork related to the use of the OBU-ro

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Criminal liability

Hypothesis 1. Personal injury or death in traffic involving a SCOOP system, e.g..:

contribution to the accident situation / creation of the conditions that made it possible as a result of the act of an agent, including negligence (design or use)

- Criminal liability of natural persons
  - Legal background
    - The causal link: direct / indirect causal distinction
    - The fault
      - wilful misconduct and standard
      - gross negligence and knowledge of the risk
    - Criteria for the performance of normal due diligence in his professional activity by the agent
  - *to be illustrated with risks related to SCOOP and the criminal risk for agents*
- Criminal liability of legal persons
  - are concerned in SCOOP: *private partners*, local authorities, public institutions

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Criminal liability

Hypothesis 2: Infringement of drivers' rights resulting from computer files and processing due to:

- a risk related to a security breach (*)
- failure to comply with the technical and organisational measures taken as presented to the CNIL or in non-compliance with applicable legislation

Sanctions incurred

- criminal
  - application of the penalties provided for in the Criminal Code (arts. 226-16 et seq.)
- administrative
  - application of the sanctions provided for in the GDPR

(*) *this loophole may also make it possible to identify a fault contributing to the occurrence of an accident likely to give rise to liability on this ground*

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Liability towards agents

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- **Geolocation** and measures taken in SCOOP
  - State of law
  - Analysis of cases of typical case law that can be transposed to SCOOP cases
  - Reminder of the measures taken in SCOOP and to be taken for the future

– Risks related to **distraction** or **overwork**
  - Work carried out on the Grand Ouest site - impact of distraction?
  - Elements in the work on acceptability (Ifsttar; Cerema)
    - e. g. unsuitability of the application's operating mode to the professional activity (having to enter information simultaneously in overload, not time)

– The impact of **waves** on health
  - *not covered, but an important subject that will concern all users of public space exposed to a multitude of cumulative sources of wave emissions*

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Transposable" case law illustrations

Risk management by the administration and its agents

- A known, foreseeable or unpredictable risk by the administration
- The distance between the information delivered to the user and the problem detected
- The intervention time of the operating agents to correct the problem / the prioritization of the information delivered

Information provided to the user

- Non-delivery of information to the user
- Incorrect, inappropriate or inappropriate information
- The readability of information
  - how the alert is issued
  - consistency with regulatory signage
  - contradiction with another source of information
- A message that encourages the user to make a wrong decision
  - the message is not consistent with the predictable reaction of a normal conductor
  - user distraction by the system

Examination of the criteria analysed in Part 1

Case law illustrations // Scoop

Methodology

- Analysis of administrative and criminal case law
- Examination of the circumstances under which the responsibility of the administration and/or agents can be retained or excluded
- *Perspective: projection for C-ITS cases*

Conditions for a relevant analysis have useful information, appropriate deliverables and work in an interdisciplinary manner

Important criteria: knowledge of the risk or predictability of the risk

- SCOOP is in itself a risk knowledge tool
- Two hypotheses
  - knowledge of road events by the device itself
  - predictability or unpredictability of a system malfunction
- Measures taken to anticipate the risk and hinder its realization?
  - e. g. organizational measures (prioritization of events to be transmitted); system monitoring measures, instructions on measures to be taken in the event of malfunctioning

Illustrations by use case analysis

- Proposed assumptions *(for further study)*
  - Scheduled site alert
  - Alert for track intervention or unsecured accident area
  - Obstacle alert on the roadway

Specific study requiring the mobilization of many partners

- In each case, analyse the potential legal risks of each actor (including the driver)
  - based on proposals made in past research
    - Guilbot *et al* AJAR, INRETS, July 2010 (Annex 7, *Intelligent Speed Management*)
  - by taking into account, on a prospective basis, the case law that may be transposed
  - What about the impact of C-ITS on these responsibilities?
    - to engage responsibilities
    - or on the contrary to reduce legal risks

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THANK YOU FOR YOUR ATTENTION

Drawing Joël Yerpez. Predicted 3. Kissifrot

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Questions / answers

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Demonstration

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Coffee break

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Road safety impact

Laura BIGI, Cyril CHAUVEL, Erwan LECUYER

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Summary

- Context - Experimentation
- Method & Analysis
- Results
- Conclusion & Recommendations

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Context - Experimentation

Evaluation carried out mainly in Bordeaux

- SCOOP vehicles equipped with sensors and recorders, driving on open roads
  - Initially, naturalistic approach planned in Ile-de-France and in the Western area.

  - Less vehicles rolled out into the fleet than forecasted

    => Development of an alternative protocol applied in Bordeaux city
    - Each of the 30 participants drives for one week and drives also on the ring road
    - SCOOP vehicles need specific equipment

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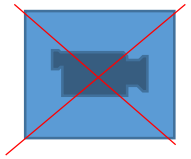
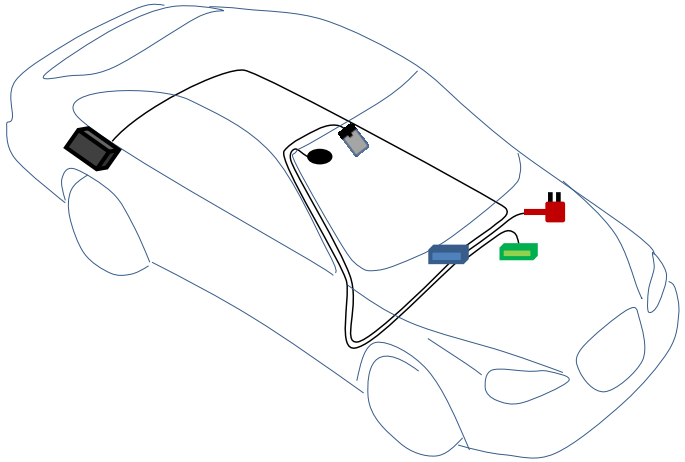
Data recording system

No camera



- GPS
- Mobileye
- **Datalogger (DAS)**
- CAN connector
- SCOOP@F unit
- Power supply



- Data recorded(synchronized)
  - Position
  - Vehicle data: speed, braking, steering wheel angle…
  - Context information : Inter-distances, traffic signs, obstacles types, …
  - Display / messages transmission

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Context - Experimentation

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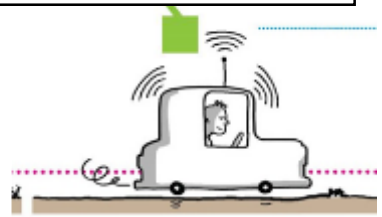
Sampling: analysis of 600 displayed messages => 39 messages with a distance to the event going until 3,4 km.

- **Elimination of messages :**
  - Obstacles too far
  - Competition with speed limit traffic sign
  - Low initial speed
  - Bug / driving speed recording, ….

Event reception : message displayed



⇒12 messages selected for the evaluation : distance to the events < 600m.

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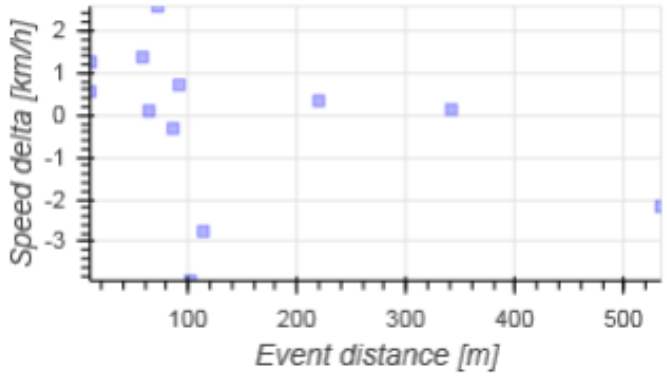

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Use cases : types B,D,E

Messages displayed

SCOOP messages	Simplified messages
Alert stationary vehicle	Stopped vehicle
Alert breakdown	Stopped vehicle
Alert Accident area	Accident
Alert Animal on the road	Animal
Alert Animal on the road - herd	Animal
Alert people on the road	People
Alert obstacle on the road	Obstacle
Alert operator vehicle in intervention. Operator vehicle stopped for protection	Road working
Alert planned road works. Fixed road works	Road working
Alert unmanaged blockage of a road	Obstacle
Alert extreme weather conditions	Weather
Alert extreme weather conditions - Strong winds	Weather
Temporary slippery road alert	Ice
Temporary slippery road alert – persistent ice	Ice

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Method & Analysis

Accident analysis Stakes and real benefits

Frequency

Scoop@F use cases

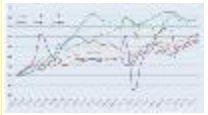
Severity

Scoop@F use cases

Accident analysis Stakes

Driving data recording

Data analysis



Driver behaviour analysis / driving speed

Real SCOOP Efficiency

Road safety Benefits

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MINISTÈRE CHARGÉ DES TRANSPORTS

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Projet SCOOP véhicules et routes connectés connected vehicles and roads

Method & Analysis

Accident analysis Stakes: 2 criteria

Accident types

FATAL

at least one fatality

INJURED

at least one injured victim

Severity for victims

Dead

Injured

Not injured

Criteria

Frequency

Severity

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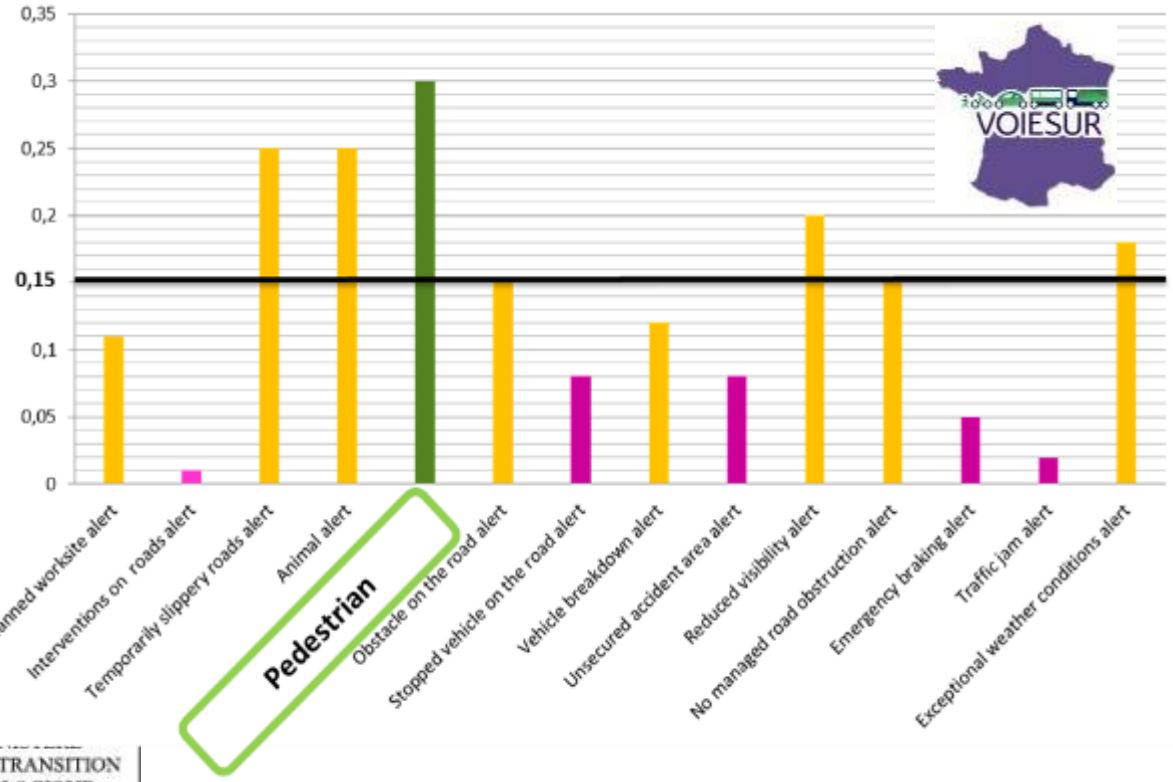
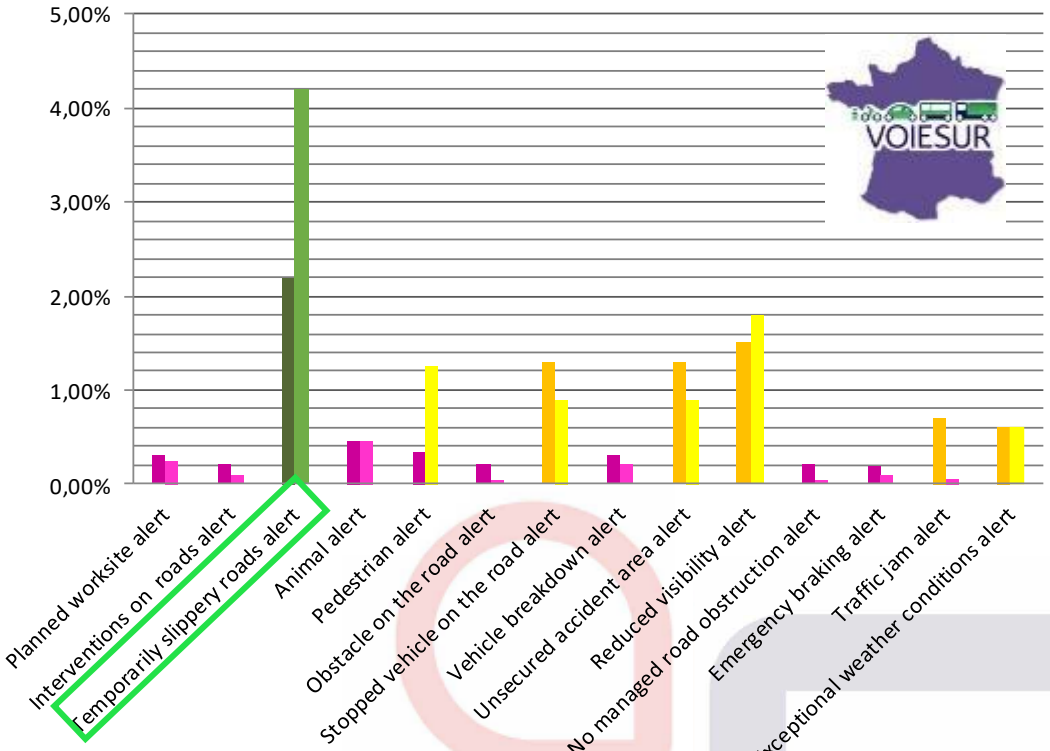
Results: passengers cars



Accident severity



Accident frequency

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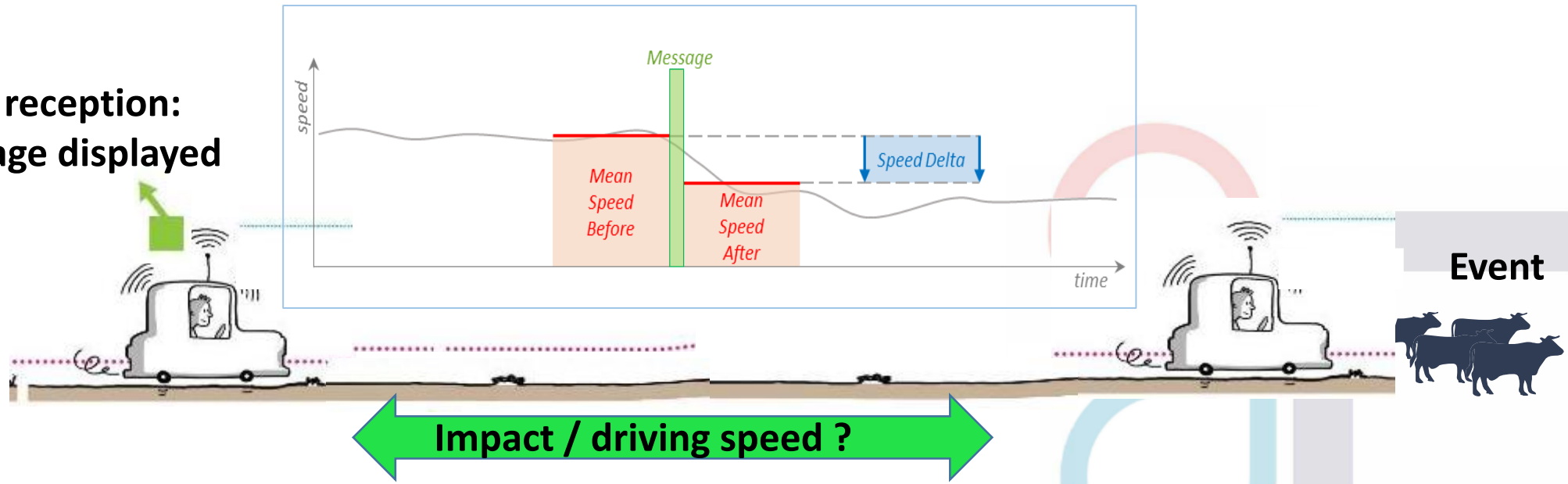
Method & Analysis
Real SCOOP efficiency

- **Efficiency / accident frequency reduction:**
  - % of situations with reduction of driving speed

$$Ef = 1 - (R_{avec}/R_{sans})$$

- **Efficiency / accident severity reduction:**
  - Determined from the pedestrian impact and the front impact risk curves = f(driving speed), respectively

Event reception: message displayed



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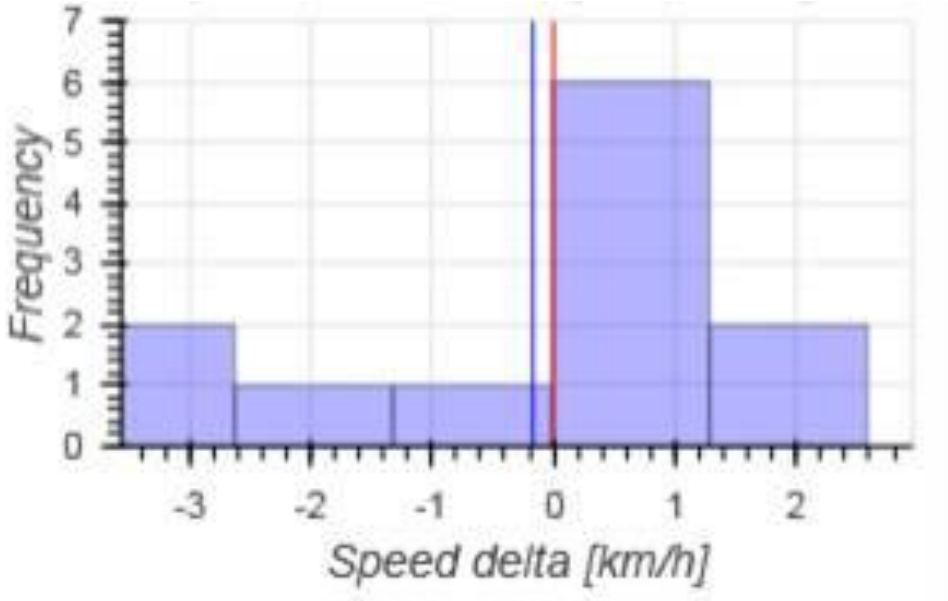
Efficiency / accident frequency reduction



Deceleration: 4 cases / 12
33 % [8 % - 58 %]

Efficiency: 33 %

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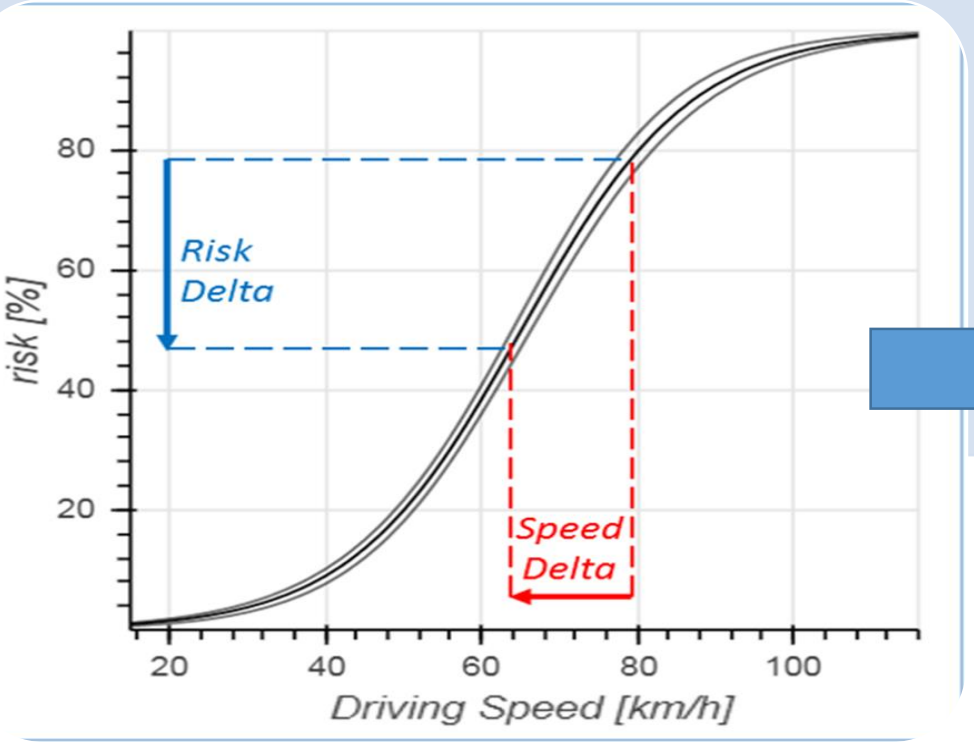
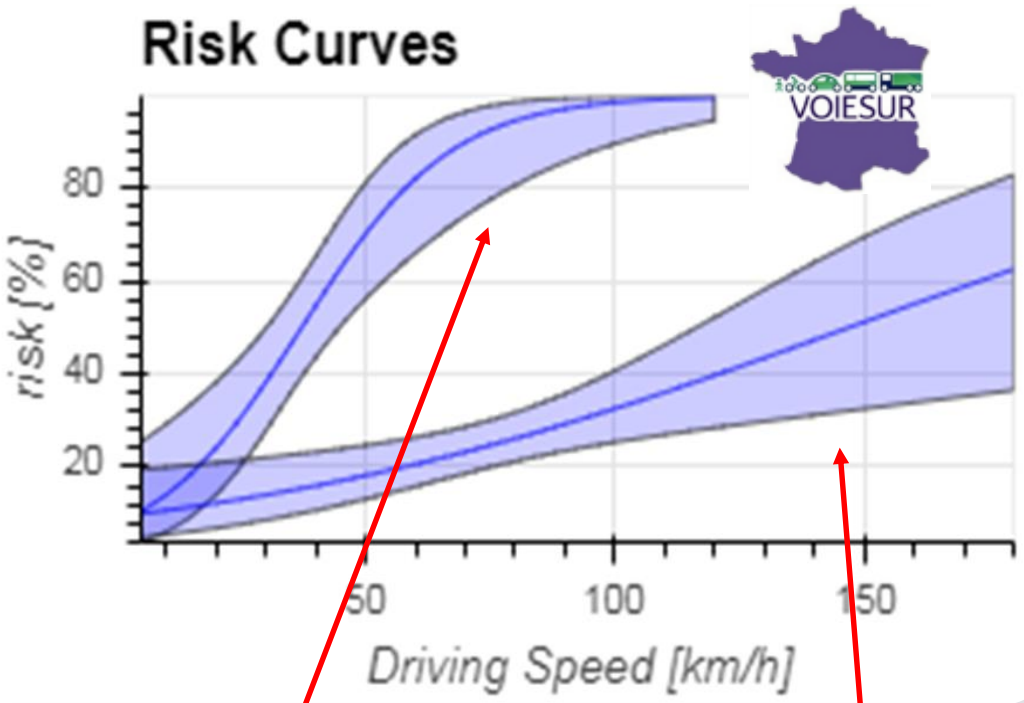
Risk curve / Severity (dead + seriously injured)





Theory

Pedestrian impact

Front impact

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Efficiency / accident severity reduction

(dead + seriously injured)

- Application of the risk curves: **distinction between véhicle/pedestrian impact and vehicle/vehicle or obstacles impact** (use cases grouping)

	Value	Confidence interval
Mean of pedestrian impact efficiencies (%)	**-0,34**	**[-1,63 % ; 0,51%]**
Mean of front impact efficiencies (%)	**0,13**	**[-0,99% ; 1,43%]**

Insignificant efficiency ~ 0

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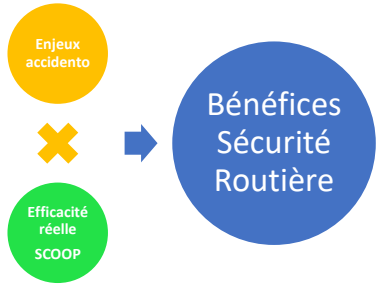
Results



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- **Benefits / fatal and injured accidents reduction related to the use cases**

Estimation	Benefits / accidents reduction
For each use case	From 0 to 1,4% (fatal and injured)
Global: all use cases	From 3% (injured) to 4% (fatal)
Accidents reduction, if 100% of the fleet is equipped (cf. ONISR 2018)	1296 (injured) ; 84 (fatal)
Maximum reduction of injured accidents, if 100% of the fleet is equipped (cf. ONISR 2018) = the global stake of all use cases	Benefit max = 10% (global stake)
	4320 injured accidents / 230 fatal accidents

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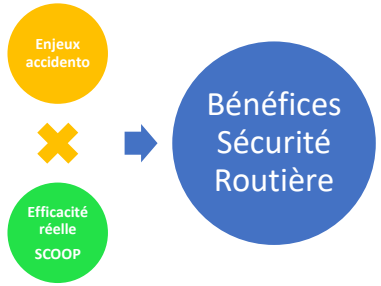
Results



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- **Benefits / accident severity reduction related to the use cases**

Estimation	Benefits / severity reduction
For each use case	Insignificant ~ 0
Global: all use cases	Insignificant ~ 0
Maximum reduction of dead and seriously injured, if 100% of the fleet is equipped (cf. ONISR 2018) = the global stake of all use cases	Benefit max = 8,4% (global stake) 1567 dead + seriously injured

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Conclusion & Recommendations

Conclusion

- **Enhanced methodology and know how**: development of a multi-approaches protocol according to the available input data and experimental context.

- **The results show a tendency in terms of road safety benefit**
  - A bigger sample should confirm it.

- **In the context of the evaluation study, the maximum expected benefit** in terms of accidents and severity reduction corresponds to the respective stakes.

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Conclusions & Recommandations

Recommandations

- **Experimental protocol**
  - Installation of camera into the vehicles
    - inside context of the vehicles: cf. driver behaviour
    - outside context of the vehicles: cf. environment/interactions with different events

- **For any future evaluation study**: to ensure a huge sampling

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Traffic Impact Evaluation

A simulation approach to evaluate infrastructure-to-vehicle (I2V) messaging impact in road congestion

LICIT - IFSTTAR

Andres Ladino

20th November 2019

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Context

Dynamic Performance & Operation → **Stability of traffic Flow**

- Measure and characterize dynamic effects of messaging policies in I2V cases in traffic flow.
- Define and study variation of different messaging policies.

Impact on traffic flow & other users → **Impact on road capacity**

- Determine the efficient effects in road capacity via alternative indicators
- Establish indicators at the network level that help to define effects on congestion.

Side effects → **Environmental effects**

- Specific maneuvers can impact traffic producing more accelerations or decelerations. Hence side effect contributions are also desired to be evaluated.
- Evaluate the potential impact in this context

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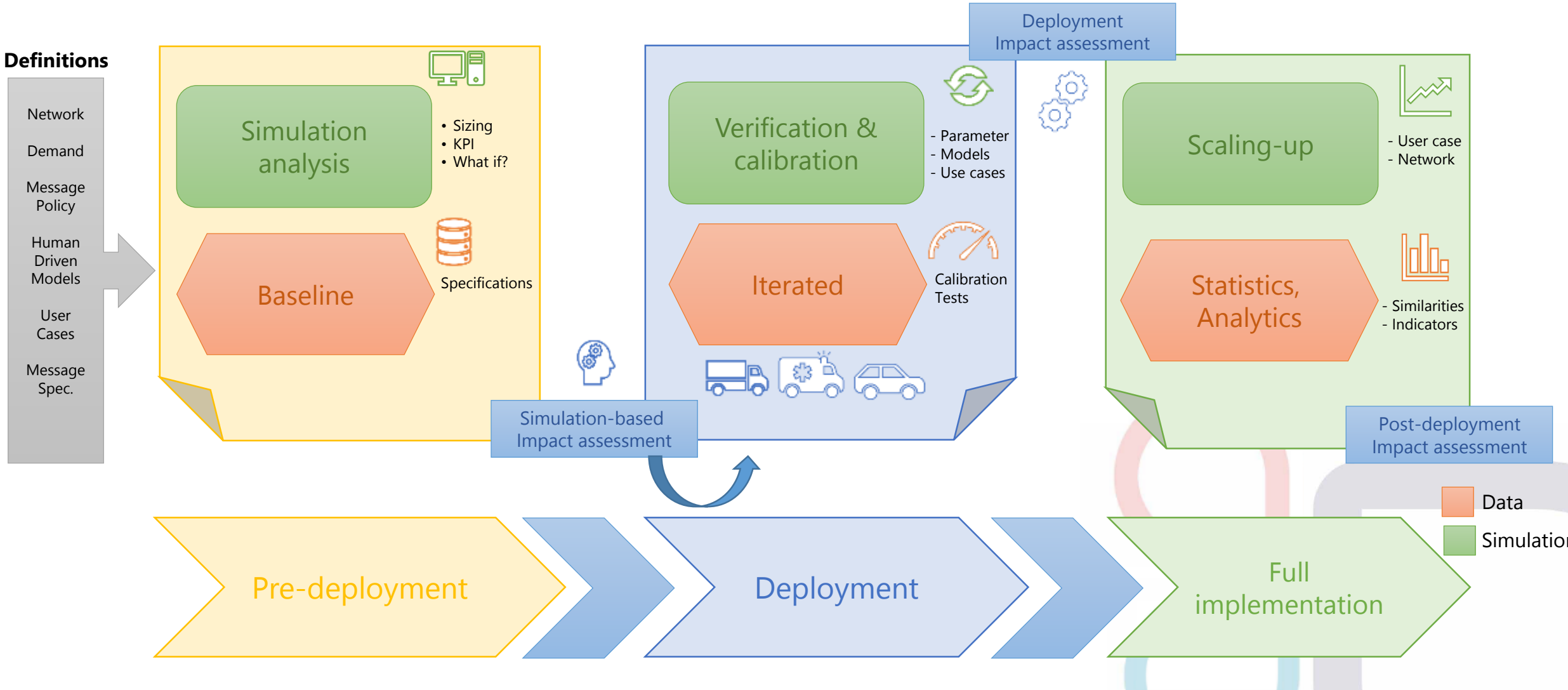
Methodological framework



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Research questions

Reactive

Proactive

- What are the effects of specific I2V policies on regular users compared to users affected by the I2V messaging?
- Study the impact of these effects under prescribed scenarios and situations.
  - Ex. Road works declared by the road operator.

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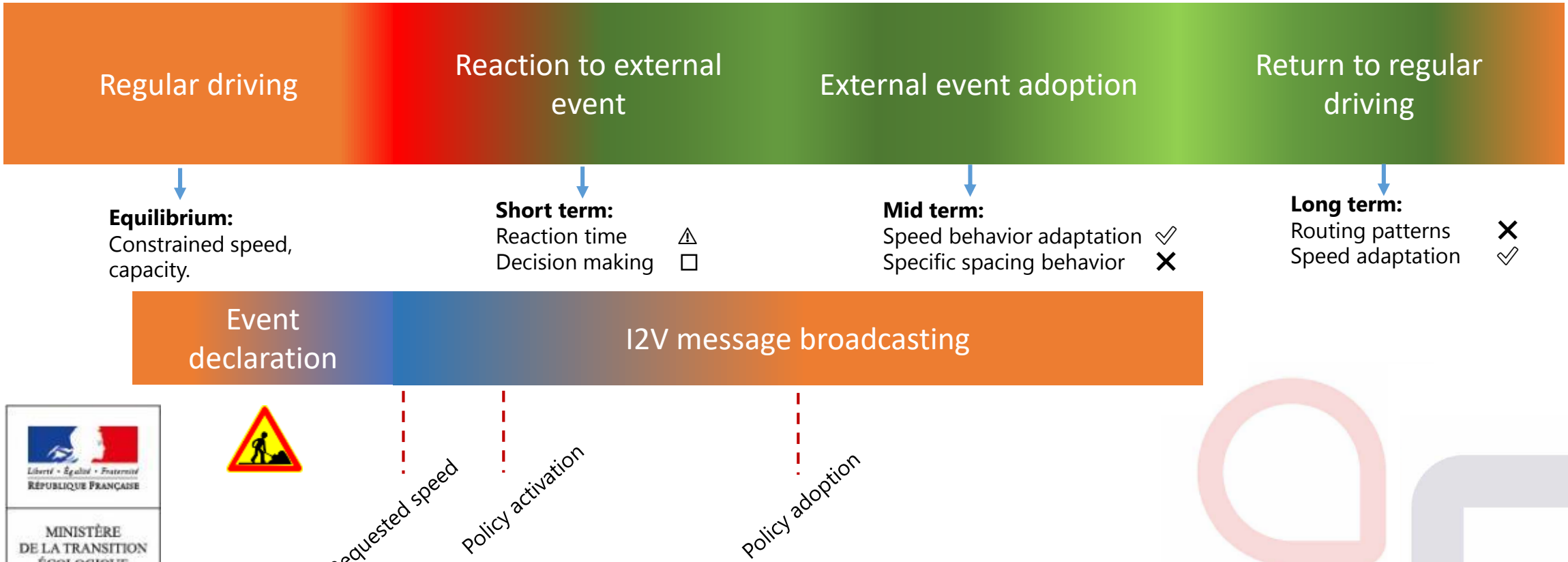
Hypothesis & Considerations



- Acceptance is mandatory at some point in the time/space
- Rates of acceptance are constant in the space

(2018) – ISO/TR 21959-1 Road vehicles — Human performance and state in the context of automated driving

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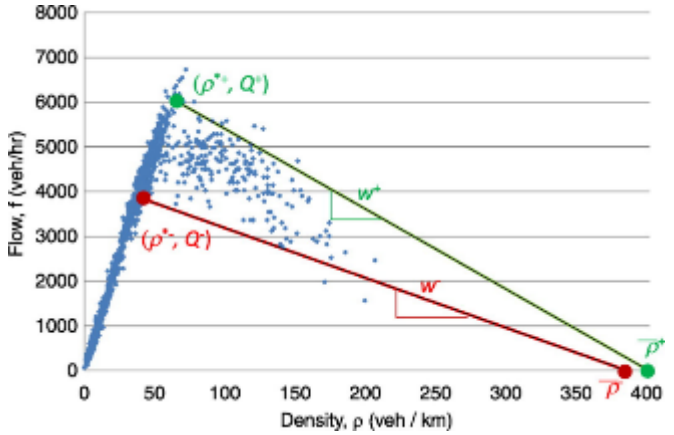
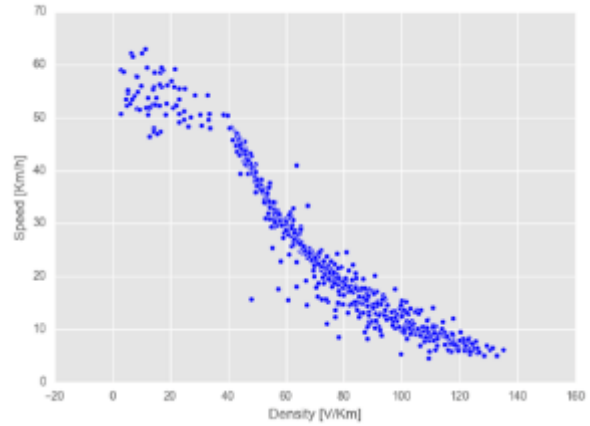
Model setup

Traffic aspects

Principles:

- Conservation law in traffic flow theory.
  - Reach a maximum flow / no storage in intersections.
- Microscopic approach for simulating realistic dynamics.
  - Bounded accelerations
  - Reaction times
- Vehicles under effects of message obey a prescribed driving policy





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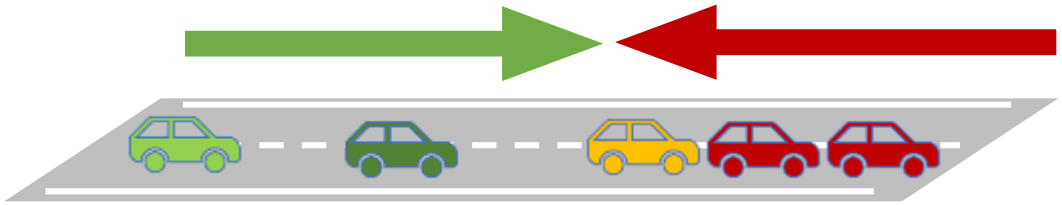
Model setup

Driver behaviour



$$a_{n(t+T_r)} = min\ (D_n, S_{n-1})$$

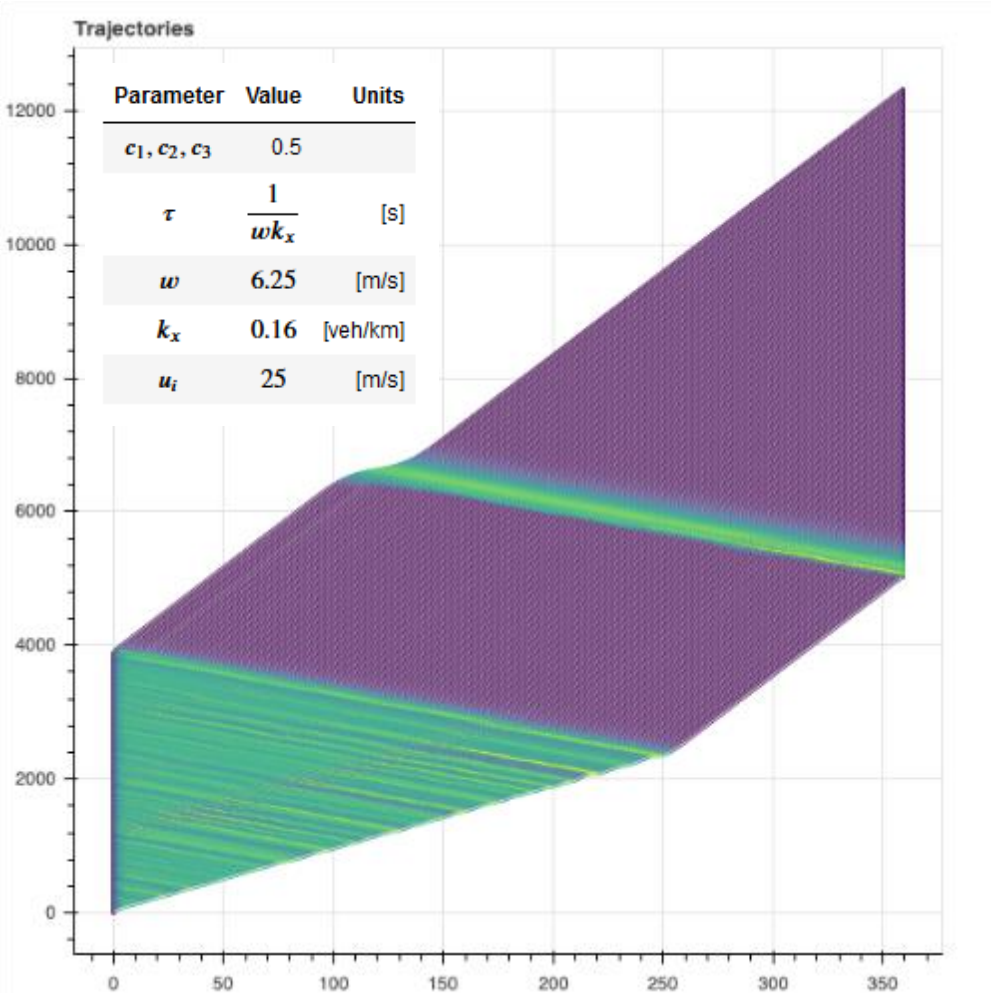
Reaction time — Demand — Supply

$$D_n = c_3\left(v^{\star}(t) - v_n(t)\right)$$

Desired speed → Traffic model; Controlled by I2V messaging

$$S_{n-1} = c_{1,n-1}\Delta v_{n,n-1} + c_2\left(\Delta x_{n,n-1} - \left(s_0 + \tau v_n(t)\right)\right)$$

Drivers' perception (ideal case) — Safety condition



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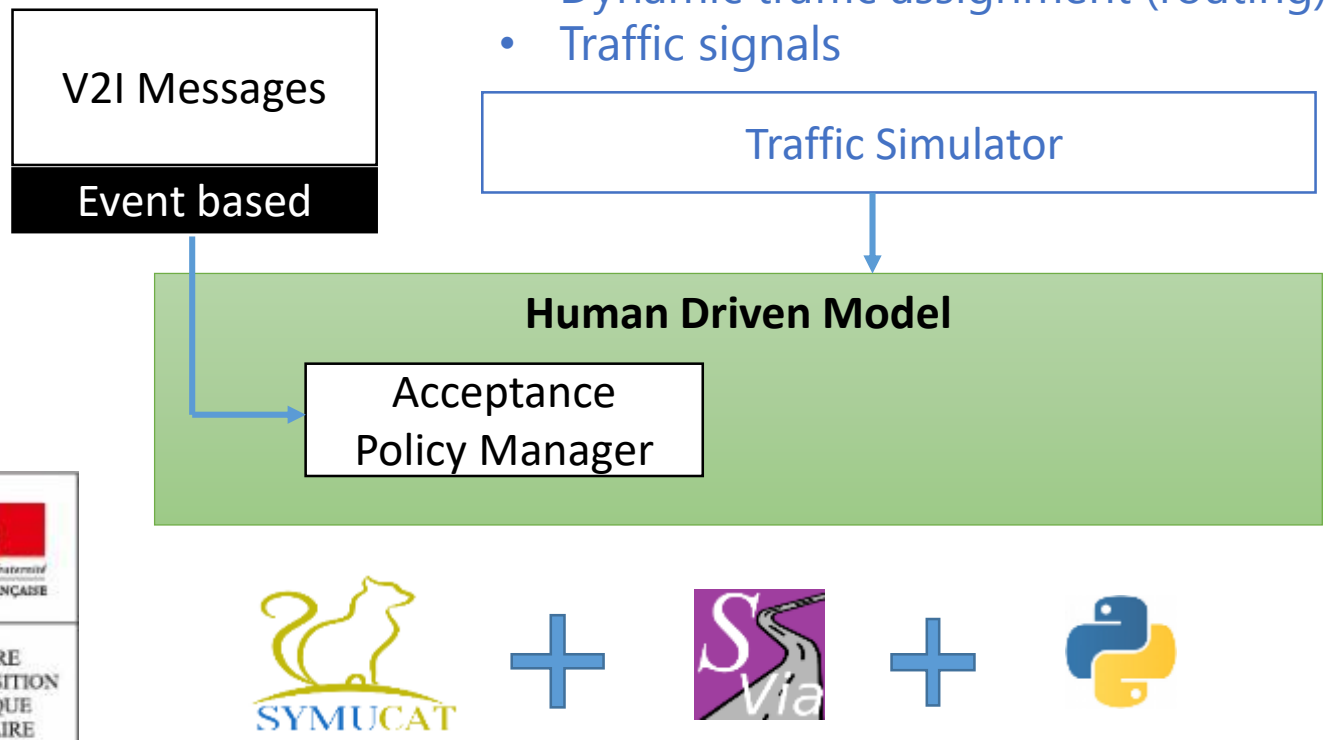
Simulation setup

- Vehicle generation
- Dynamic traffic assignment (routing)
- Traffic signals



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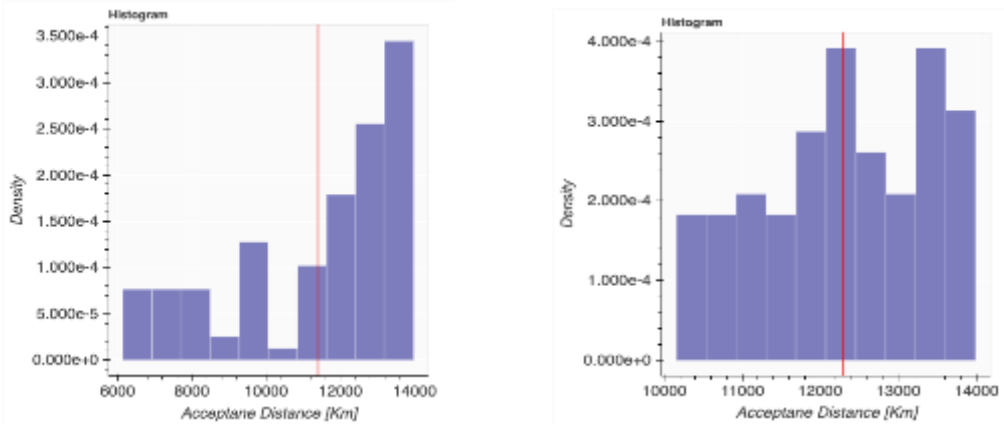
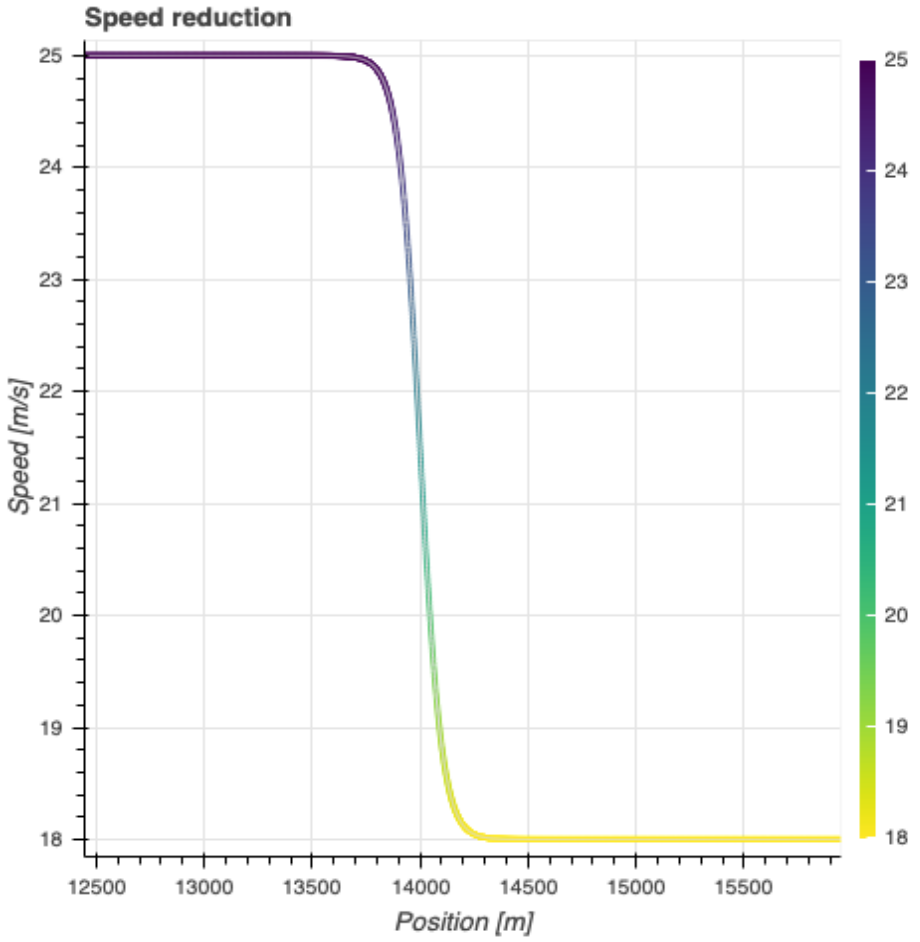
Characteristics of I2V messages

- Acceptance policy



Distance to works ~ 10Km 5Km

- Higher likelihood when approaching to works
- Unified message for all connected vehicles.
- Similar acceptance dynamics unless constrained by traffic.



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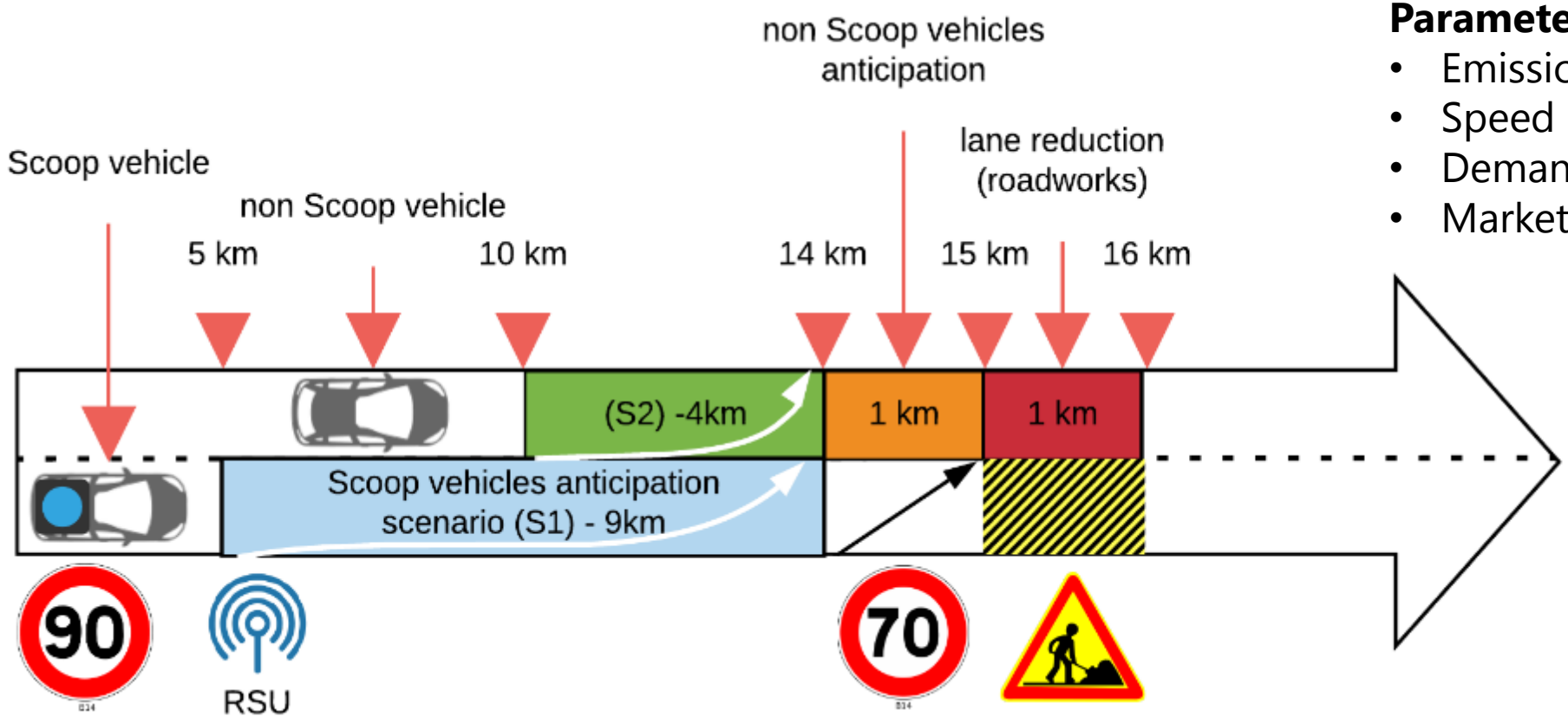
Test scenario



Parameter control

- Emission distance
- Speed drop message
- Demand
- Market Penetration rate

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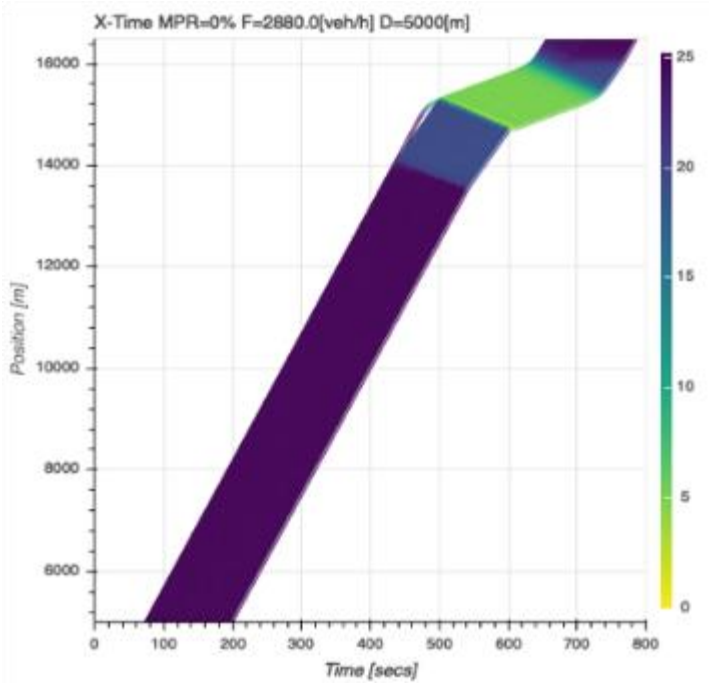
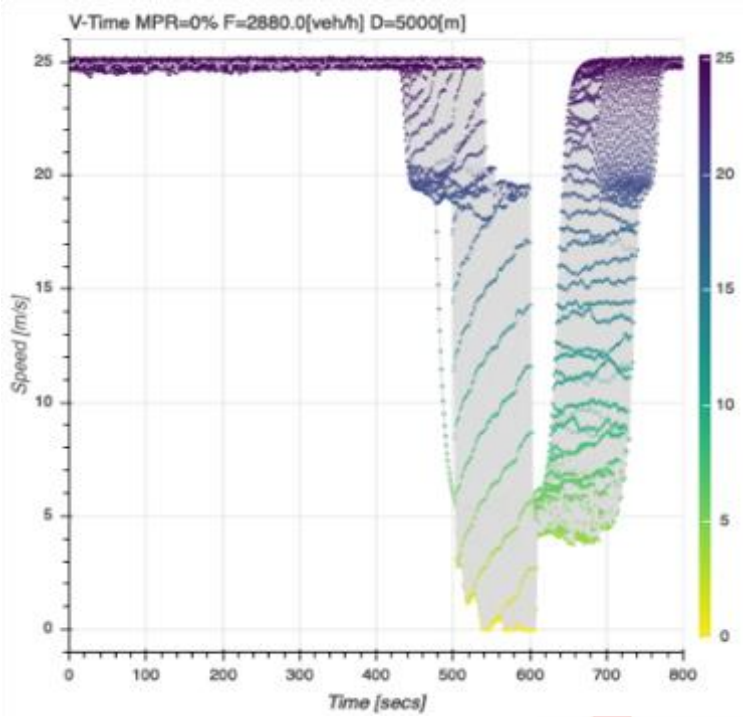
Impact on traffic trajectories





Reference scenario:

- Mandatory speed reduction @1km before works
- Effect of works is declared as a zone with limited speed (5Km/h)

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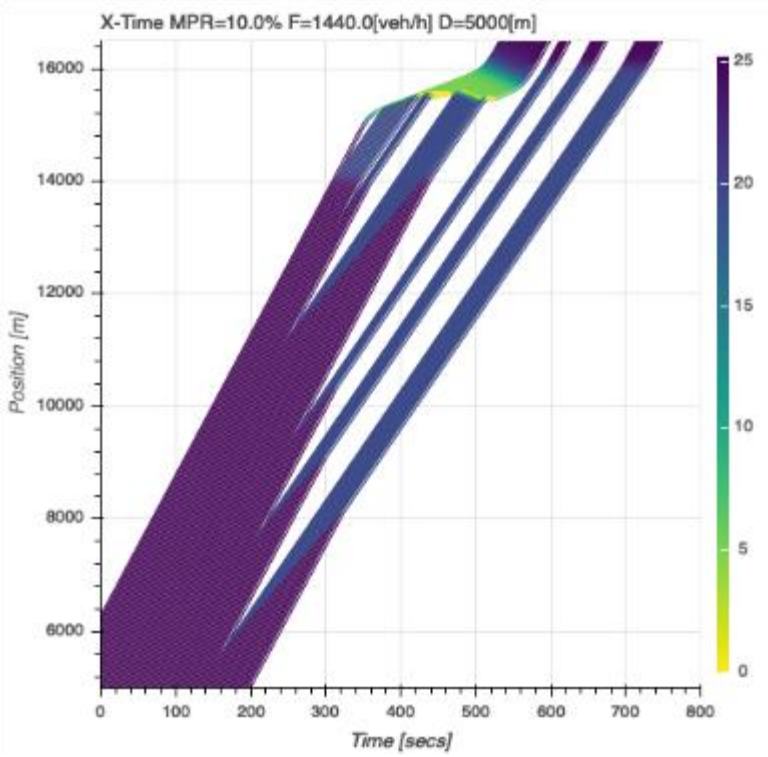
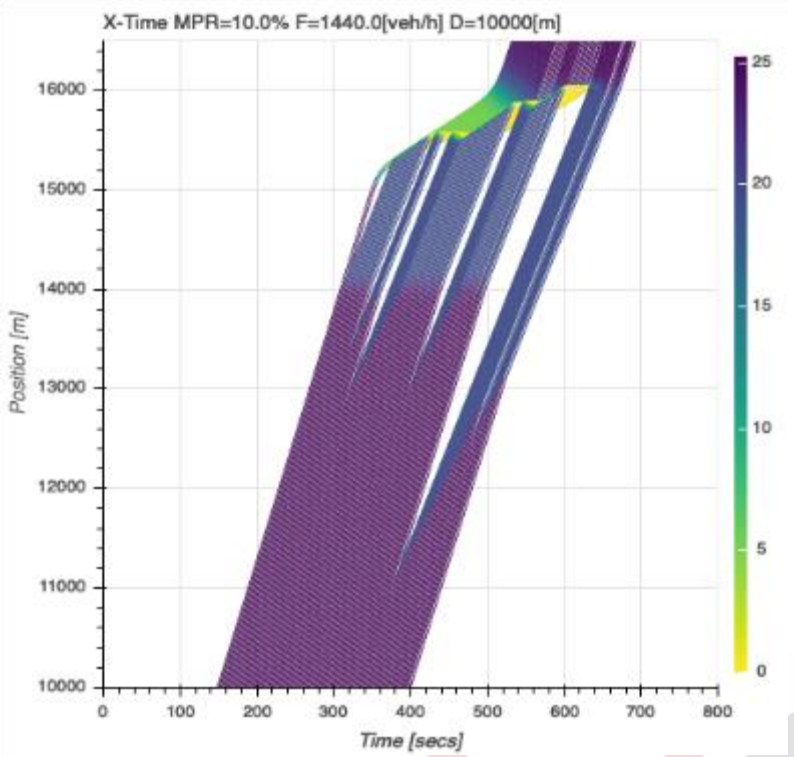
Distance effect



@5Km Distance to works ~ 10Km



@10Km Distance to works ~ 5Km

Earlier messages are good for avoiding the congestion effects from works → Increased delays if the policy is not properly selected chosen.

Optimal selection: R. Nishi, A. Tomoeda, K. Shimura, and K. Nishinari, "Theory of jam-absorption driving," *Transp. Res. Part B Methodol.*, vol. 50, pp. 116–129, Apr. 2013.

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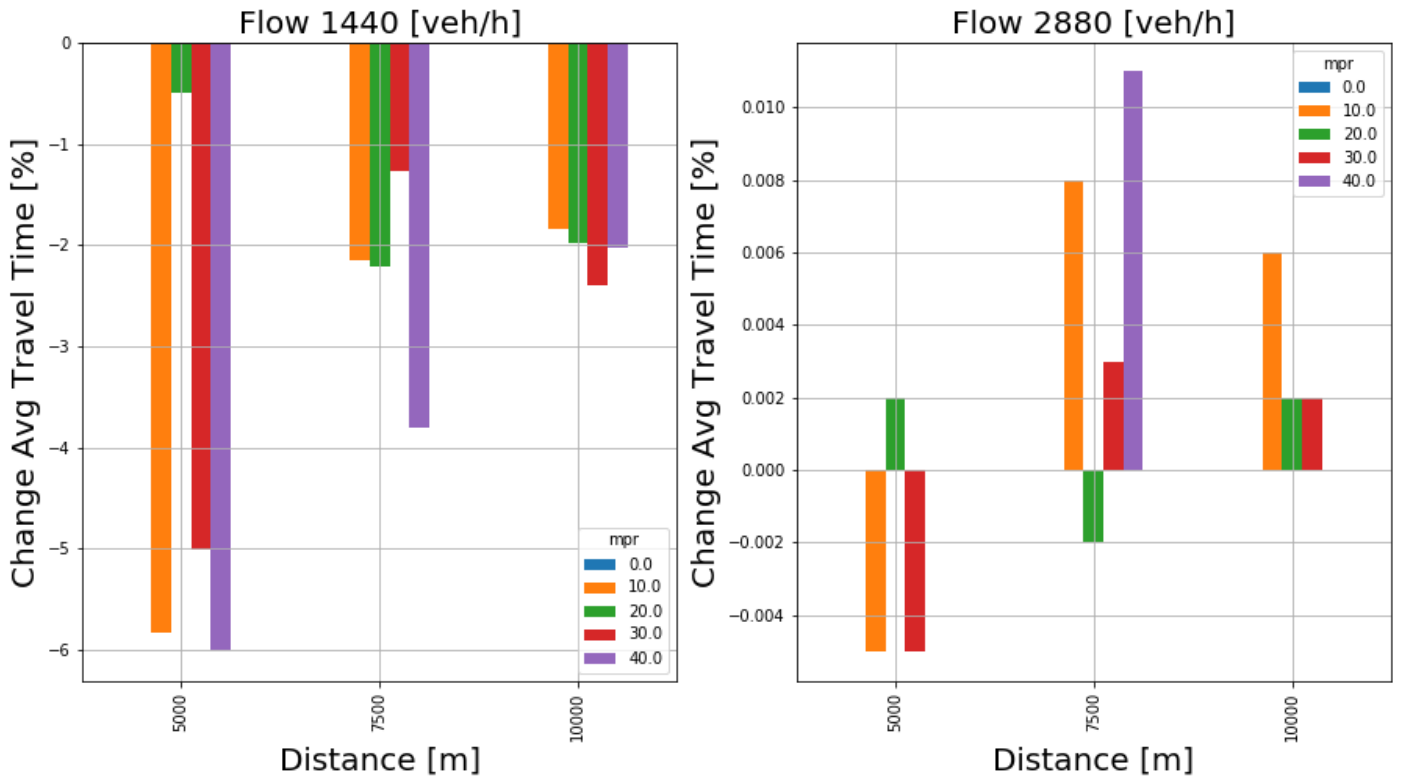
Distance effect in V2I



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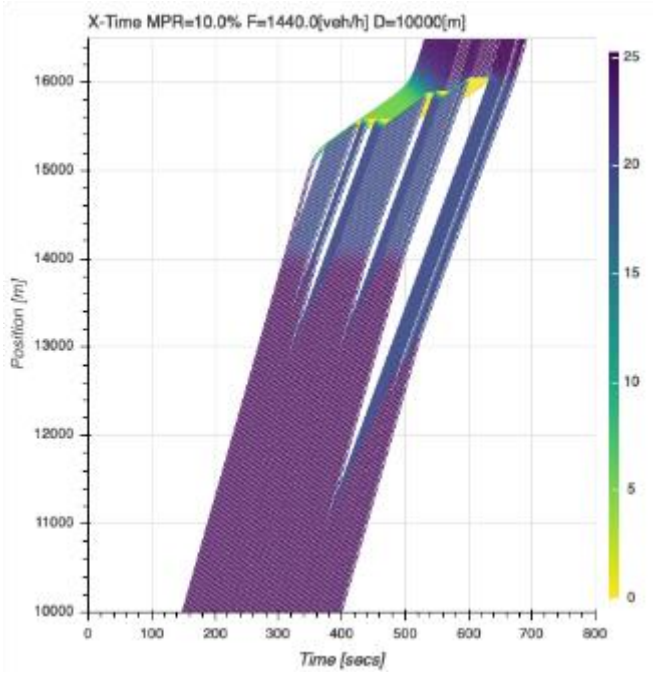
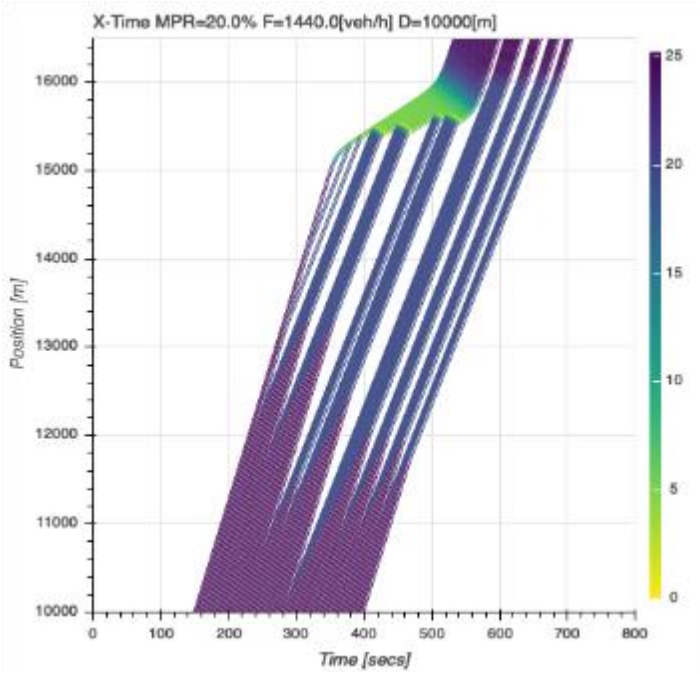
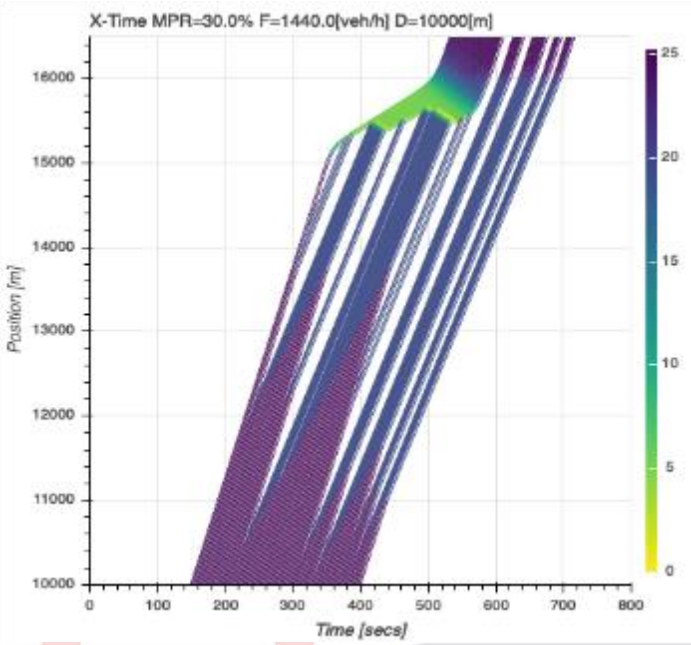
Penetration rate impact







- Spatial distribution of congestion is better achieved at higher penetration rates, effects of works are better avoided.
- Nevertheless, as observed before increasing the penetration rate may also have an impact on the network delay

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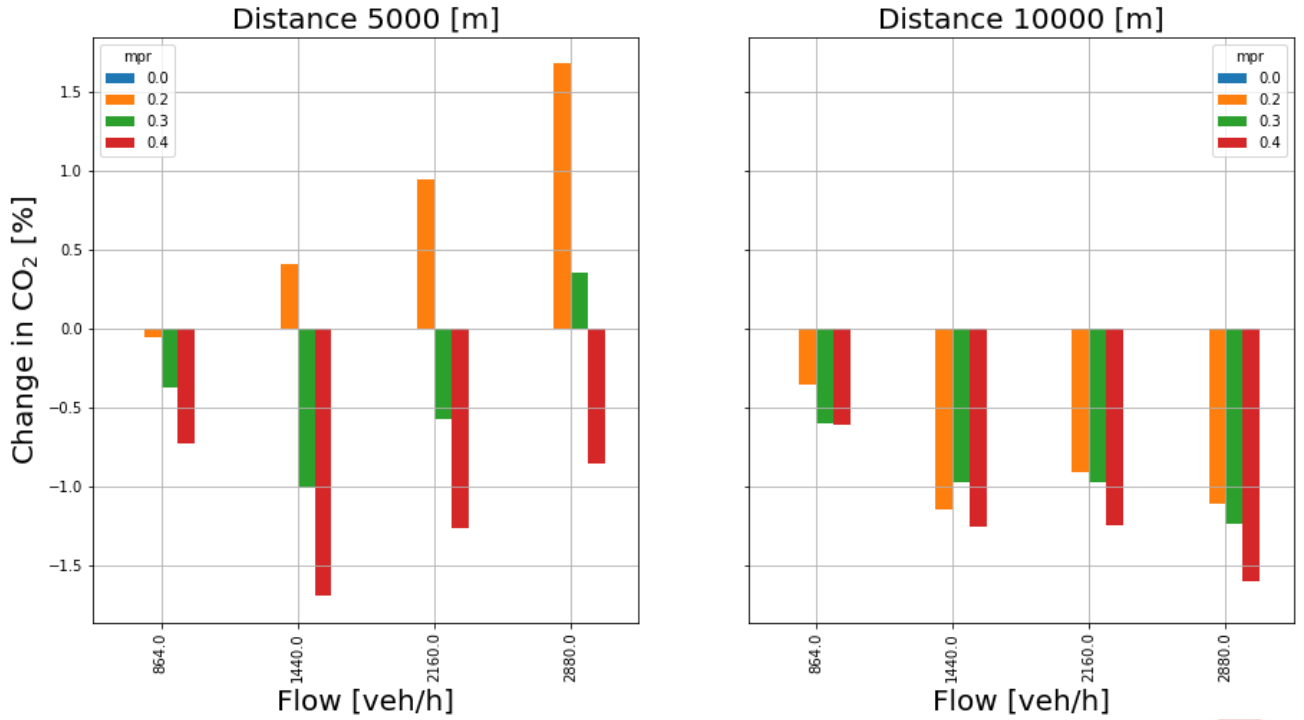
Environment CO_2 emissions

Potential Impact



Earlier messages may potentially increase the impact of CO2 emissions

Penetration rate is an important factor that may also reduce the impact on CO_2 emissions.

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Conclusion

- Speed drop policies may conduct to optimal absorption of traffic effects, overestimating the speed drop may appear secondary congestions
- Effects on the Total travel time are affected when messages are sent to far away from the planned works.
- Market penetration rate itself constitute an important factor for potential environmental impacts.

Important future works:

- Analyzing the impact of delayed acceptation on policies and the effect of anarchy.
- Study cases where broadcasted messages are non uniform and adapted to the current traffic condition.

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Socioeconomic evaluation & Business models

Christophe Larue - Rémi Pochez

November 20th, 2019

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Socioeconomic evaluation of C-ITS services

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Socioeconomic evaluation

- Costs-benefits analysis of C-ITS services
  - Considering a package of use cases, including those of SCOOP, all being based on the same equipment
  - Future costs and benefits are considered with a discount rate in order to compare equivalent costs and benefits for the same reference year
  - Socioeconomic evaluation considers impacts for the whole society, not for individual parties
  - Transfer costs between parties are not taken into account
- Socioeconomic evaluation includes impacts for third parties
  - Avoided death: 3 200 000 euros
  - Avoided hospitalization(>24h): 400 000 euros
  - Avoided slight injuries: 16 000 euros

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

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Technological scenarios

- **0. Smartphone scenario** (reference scenario): connected services available only by the way of smartphone devices
- **1. 4G scenario**: embedded equipment connecting cars to the 4G network
- **2. ITS-G5 scenario**: short range communications between cars and with roadside units
- **3. ITS-G5 + 4G scenario**: short range and 4G communications
- **4. LTE-V2X scenario:** same as ITS-G5, available only from 2022
- **5. LTE-V2X + 4G scenario**
- **6. 5G short range scenario:** V2I, I2V and V2V communications based on 5G network (slicing services)

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Deployment scenarios

- In each scenario, the same pace of deployment for infrastructures is assumed in order to ensure comparability

Pace of deployment	Low	Medium	High
4G coverage for road network - in 2020 - for each additional year	 75% 2,5%	 75% 2,5%	 75% 2,5%
Roadside units coverage for main network - in 2020 - for each additional year	 15% 3,5%	 30% 7%	 30% 7%
Roadside units coverage for secondary network - in 2020 - for each additional year	 2,5% 0,25%	 5% 0,5%	 5% 2,5%
Roadside units coverage in main urban areas - in 2020 - for each additional year	 7,5% 2,75%	 15% 5,5%	 15% 8,5%
5G coverage	Idem roadside units, starting from 2024		

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Deployment scenarios

- Three scenarios for the deployment of embedded equipment into the vehicle fleet have been considered (those scenarios include aftermarket equipement)
- **Low scenario** : 1% per year (equivalent to 13% of sales between 2020 and 2025)
- **Medium scenario** : 3% per year (equivalent to 40% of sales between 2020 and 2025)
- **High scenario** : 5% per year (equivalent to 66% of sales between 2020 and 2025)

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Considered use cases

Use case	Initials	Communication modes	4G network compatibility
Emergency electronic brake light	EBL	V2V	No
Emergency vehicle approaching	EVA	V2V	No
Hazardous location notification	HLN	V2I2V, V2V	Partial
Slow or stationnary vehicle	SSV	V2I2V, V2V	Partial
Traffic jam ahead warning	TJW	V2I2V, V2V	Partial
In-vehicle signage	VSGN	I2V	Yes
Road works warning	RWW	I2V	Partial
Weather conditions	WTC	I2V	Yes
Green light optimal speed advisory	GLOSA	I2V	Partial
Signal violation	SigV	V2I2V	No
Vulnerable road user protection	VRU	V2X	Partial
Wrong-way driving	WWD	I2V	Yes

- When partial 4G compatibility: quality of service is decreased by 30% due to latency and information loss (cf. evaluation of the NordicWay project)

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Reference scenario

- Road security: the statement of La Valette, in 2017, targets a 50% reduction of serious injuries in road accidents by 2030
- C-ITS being one lever to achieve this goal, the reference scenario (without C-ITS) considers a decrease in road insecurity limited to 30%
- Use of smartphone while driving: 40% of drivers in the long run
- Horizon of evaluation: 2050
  - Autonomous vehicles could become common after 2050

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Results for the medium scenarios

Scénario	1	2	3	4	5	6
EBL	0	1 660	1 660	1 328	1 328	812
EVA	0	932	932	771	771	497
HLN	2 310	2 858	3 067	2 331	2 914	2 646
SSV	528	657	700	537	665	611
TJW	1 139	1 367	1 983	969	1 824	1 564
VSGN	661	469	666	401	662	662
RWW	821	1 020	1 251	874	1 187	1 135
WTC	2 355	1 721	2 372	1 473	2 361	2 358
GLOSA	171	226	265	192	251	238
SigV	0	2 232	2 232	1 807	1 807	1 438
VRU	6	11	11	10	11	10
WWD	29	29	30	24	29	29
Double counting	-1 210	-2 147	-2 580	-1 746	-2 331	-1 933
Total benefits	**6 810**	**11 036**	**12 589**	**8 971**	**11 479**	**10 067**
Costs for vehicle + data	-7 077	-7 077	-7 432	-6 049	-7 381	-7 546
Roadside units	0	-980	-980	-980	-980	0
NPV (M€)	**-266**	**2 978**	**4 177**	**1 942**	**3 118**	**2 521**

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Net Present Values under different deployment scenarios

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Infrastructures deployment	Embedded equipement	1	2	3	4	5	6
Low	Low	-273	-1 567	-87	-1 612	-232	-18
Low	Medium	-266	1 749	**3 836**	956	2 934	1 684
Low	High	420	6 653	**8 997**	5 409	7 425	4 492
Medium	Low	-273	-1 327	-389	-1 434	-557	131
Medium	Medium	-266	2 979	**4 178**	1 942	3 119	2 521
Medium	High	420	8 936	**10 216**	7 315	8 370	6 388
High	Low	-273	-1 767	-1 105	-1 906	-1 285	182
High	Medium	-266	2 932	**3 691**	1 779	2 563	2 807
High	High	420	9 319	**10 070**	7 496	8 079	7 036

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C-ITS
Business Model(s)

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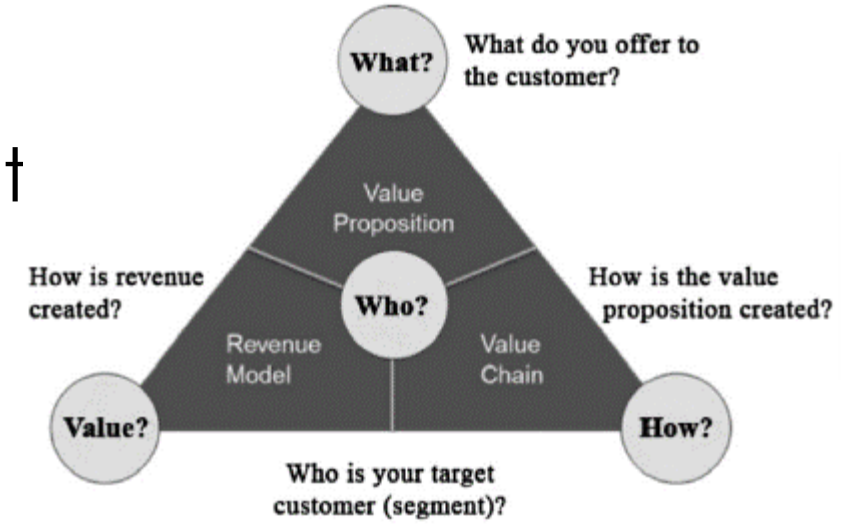
Business Model

- The way an organisation produces and delivers value to customers/users, and more generally to stakeholders

- A qualitative approach
  - Focused on the whole ecosystem (basis: Systemics)
  - As a foundation of financial considerations

- BM component



Gassmann & Al, 2014

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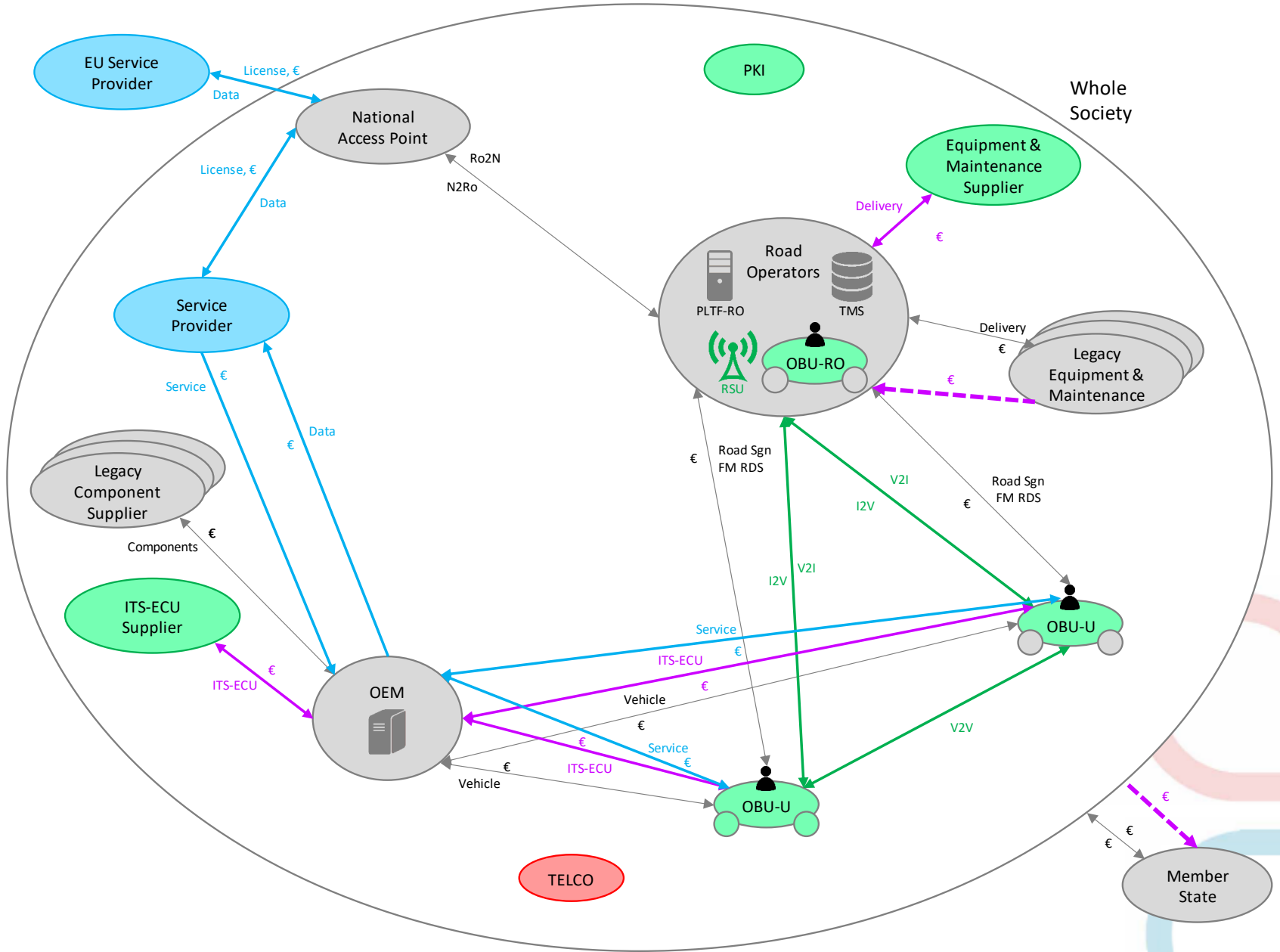
Value Network

(Example of ITS-G5-based architecture)



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Value chain – Value process creation

(Example of Road Work Warning)

Generic value chain for traffic information incl. detailed process steps			Content provision												Service provision													End User
			Content Collection						Content Processing						Service Provision						Service Presentation							
Road Works Warning triggered from the TCC - ETSI ITS G5			Detection	Data delivery	Data reception	Data pre-processing	Data delivery	Commu-nication	Data reception	Content fusion	Data processing	Quality check	Content delivery	Commu-nication	Content reception	Content fusion	Service generation	Pre-formatting	Service delivery	Commu-nication	Service reception	Service decoding	Info fusion	Service rendering	Service presentation			
Roles		**Example Actors**																										
R-ITS-S (RSU)	Operator	DIR Ouest, SANEF…							X	X	X	X	X	(1)	X	X	X	X	X	G5								
C-ITS-S (SCOOP platform)	Operator	DIR Ouest, SANEF…			X	X	X																					
Communication	Provider	Telecom operator, Unity Media, fixed cable						Cellular, Fiber or Cable																				
Service Application	Provider	TomTom, INRIX, Here																										
V-ITS-S 1	Operator	Renault, PSA…																		G5	X	X	X	X	X			
V-ITS-S 2																				G5	X	X	X	X	X			
TCC (SAGT)	Operator	DIR Ouest, SANEF…	X	X																								
Road Infrastructure (V-ITS-S-RO)	Operator	DIR Ouest, SANEF…																										
Infrastructure PKI	Operator	IDNOMIC									X											X						

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Technical evaluation

Hasnaâ Aniss
IFSTTAR

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TF Technical evaluation

- Université de Reims Champagne-Ardennes (URCA)
- Télécom Paris-Tech (TPT)
- Institut français des sciences et technologies des transports, de l'aménagement et des réseaux (IFSTTAR)

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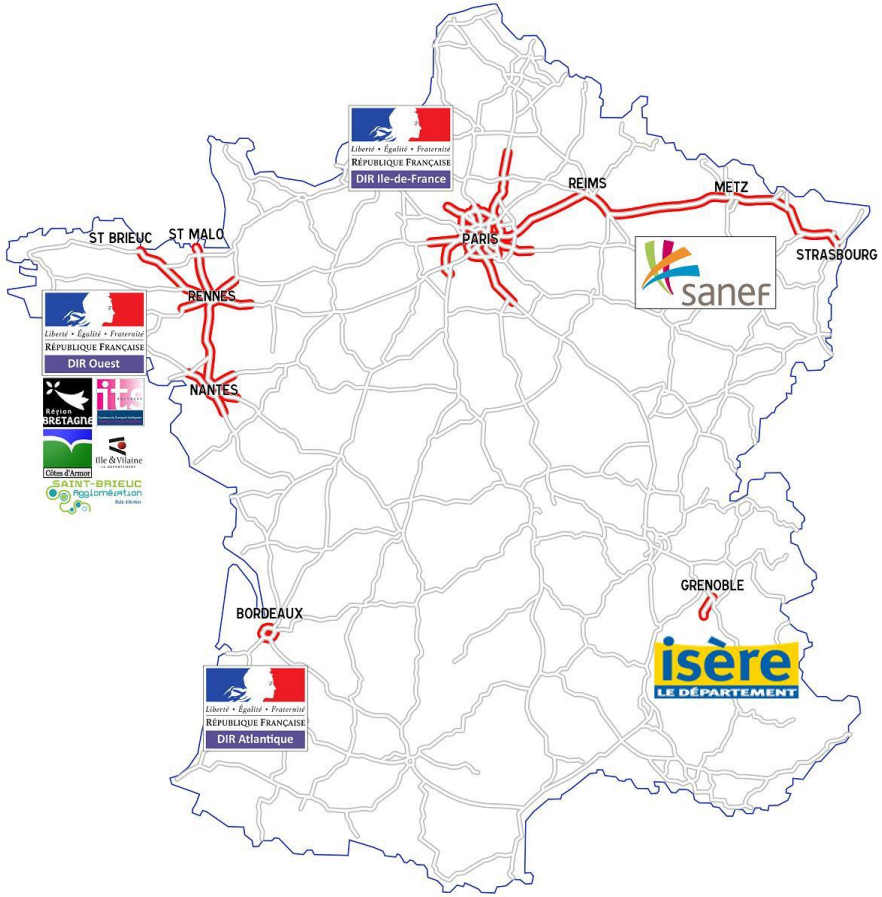
Reminder

List of SCOOP use cases
Traffic data collection
Data collection (automatic events)
Data collection (manual events)
Alert closure of part of a lane, whole lane or several lanes
Alert planned closure of a road or a carriageway
Alert planned road works – mobile
Alert Road operator in intervention
Alert end of queue by a road operator vehicle
Winter maintenance
Alert Temporary slippery road
Alert Animal or people on the road
Alert Obstacle on the road
Alert Stationary vehicle, breakdown
Alert Accident area
Alert Reduced visibility
Alert Unmanaged blockage of a road
Alert Emergency brake
Alert End of queue
Alert Extreme weather conditions
Alert Wrong-way driving
In-vehicle signage (embedded VMS)



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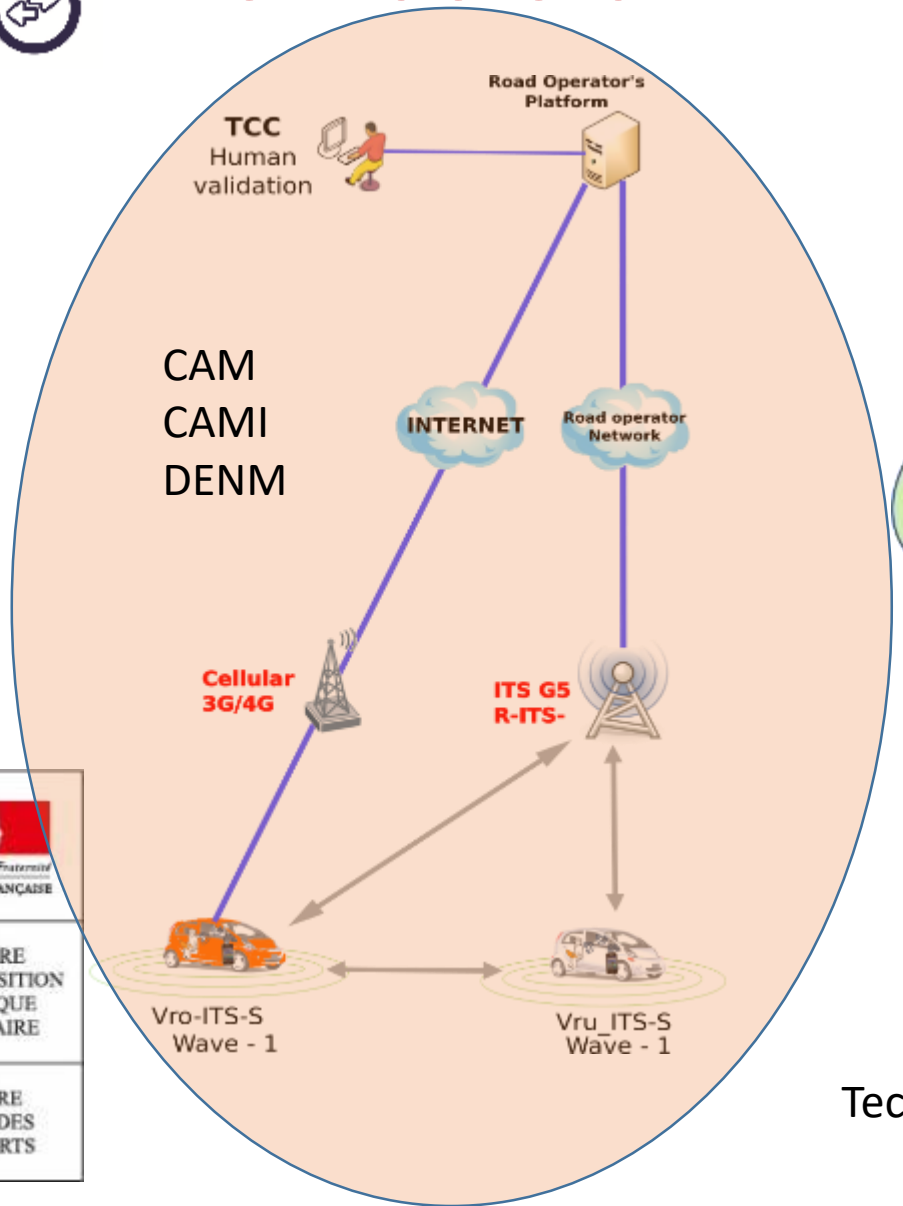
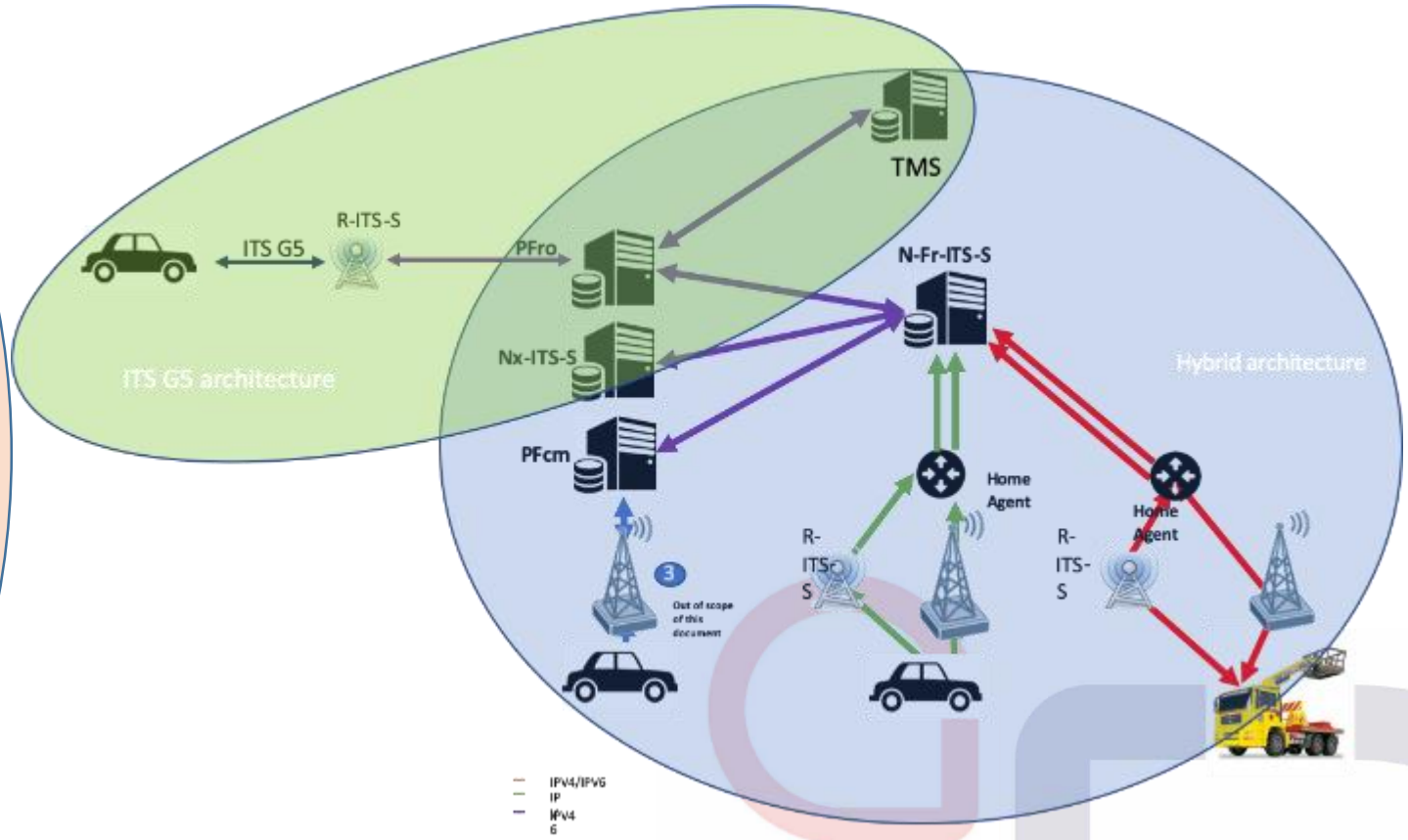
Architecture





Technical evaluation with data collected during a year

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Methodologie

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- Technical evaluation aims at defining if specifications are good enough to ensure C-ITS services optimal performances
- Naturalistic study:
  - drivers have no driving instructions
  - only real events are sent by road operators
- Company fleet and private cars
- Drivers have the option to disable data collection
- DENM data were collected for each event triggered and for each event received
- CAM data were collected each time the station was in the vicinity of another C-ITS station
- Different research questions about performances and UC are defined and we try to answer them through this analysis

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A few figures

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- Number of CAMI received : 586 700
- Number of CAM sent by V-ITSS: 10 174 437
- Number of CAM received : :140 208 - 1,4% were received by a V-ITS-S
- Number of DENM Sent by V-ITSS : 572 993
- Number of DENM received from V-ITSS and R-ITSS: 109 019 with 21% from a V-ITS-S.
- 4% of DENM sent by V-ITS-S were a cancellation of a DENM and 31% of them were received by a V-ITS-S

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A few figures

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- 3117 events were generated by vehicles
- 707 events were received (from V-ITS-S or R-ITS-S)
- 10% were manually triggered by the driver
- Due to the data collection method, no figures on the number of vehicles are availabl via the analysis, only the number of ID stations that have triggered or received an event
  - 2033 stationID sent DENMs
  - 137 stationIDs received DENMs
  - 476 stationIDs received CAMs
  - 3867 stationIDs sent CAMs

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Interaction betwenn R-ITSS and V-ITSS

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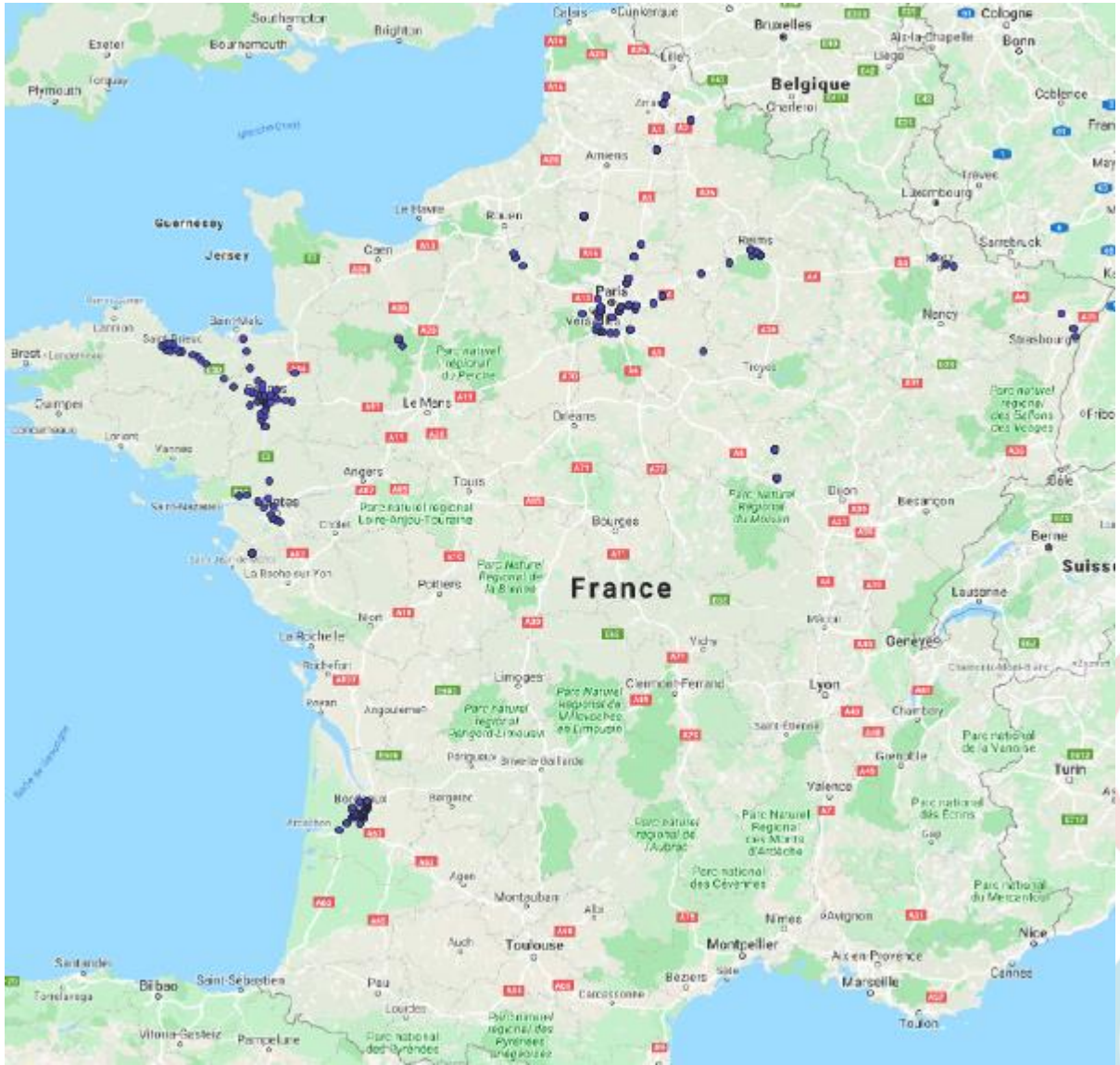

Map of R-ITS-S for which a V-ITSS has received a CAMI

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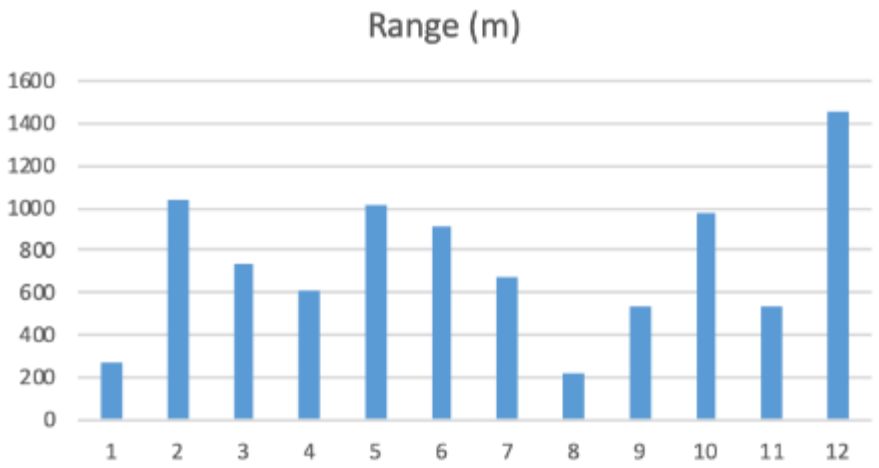
Range



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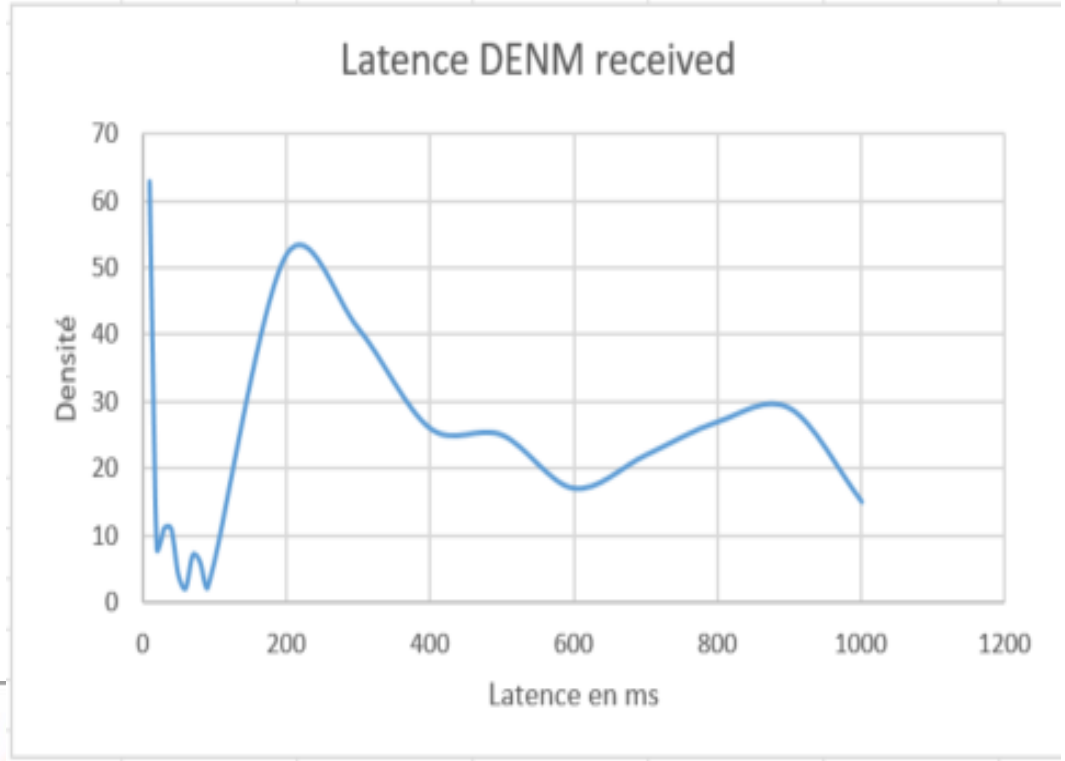
Latency



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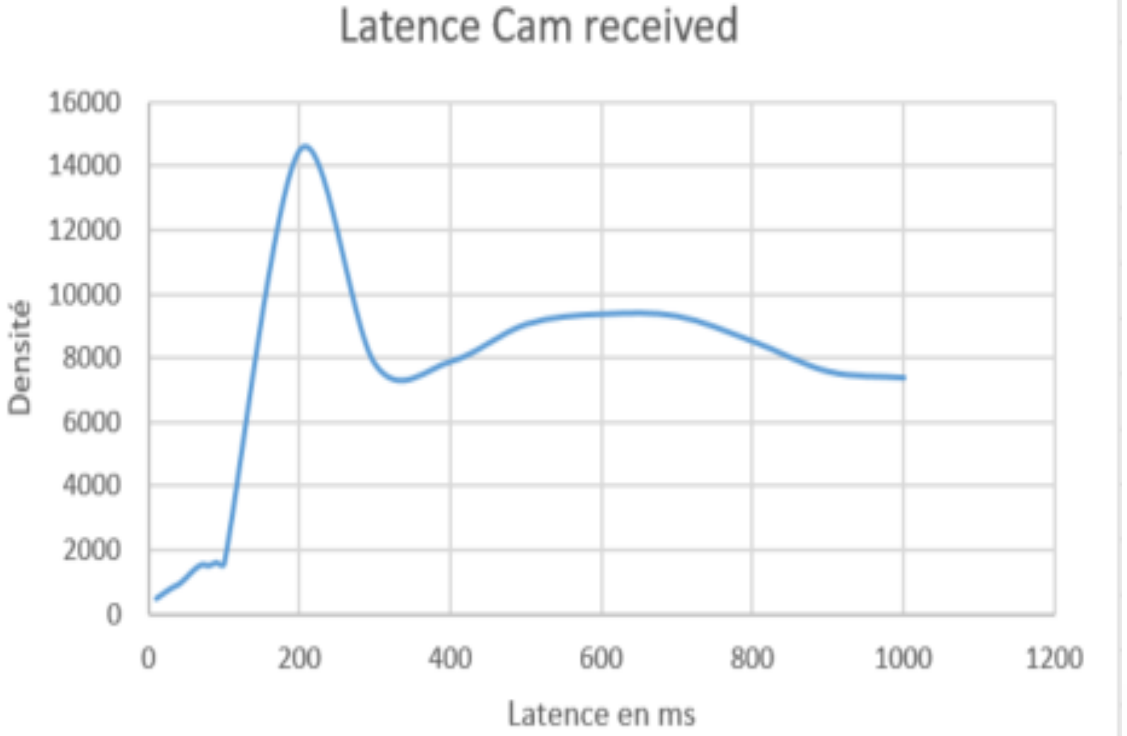
3rd Qu.	596.7425



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CAM analysis

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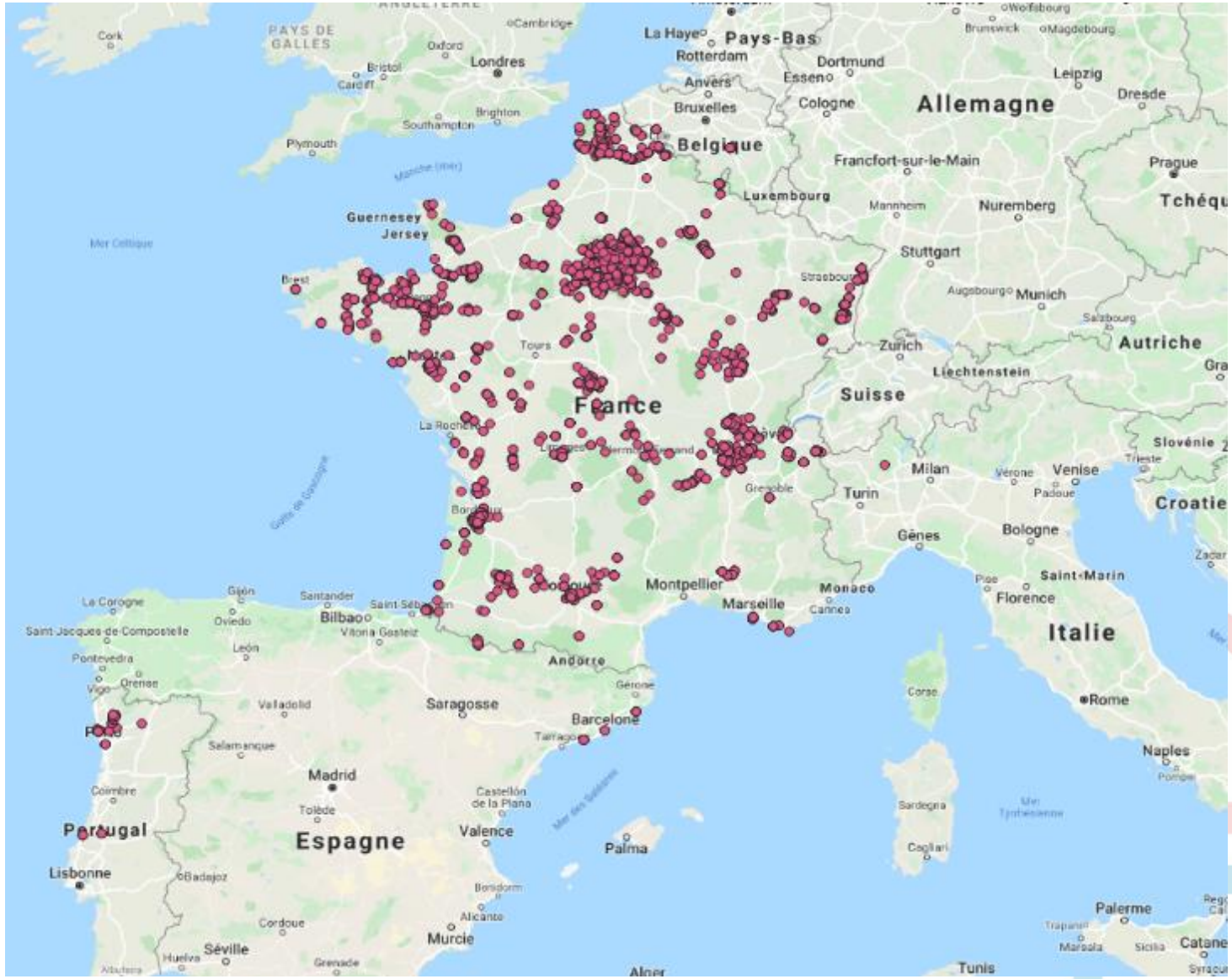
Event map sent by V-ITSS



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Event map sent by V-ITSS

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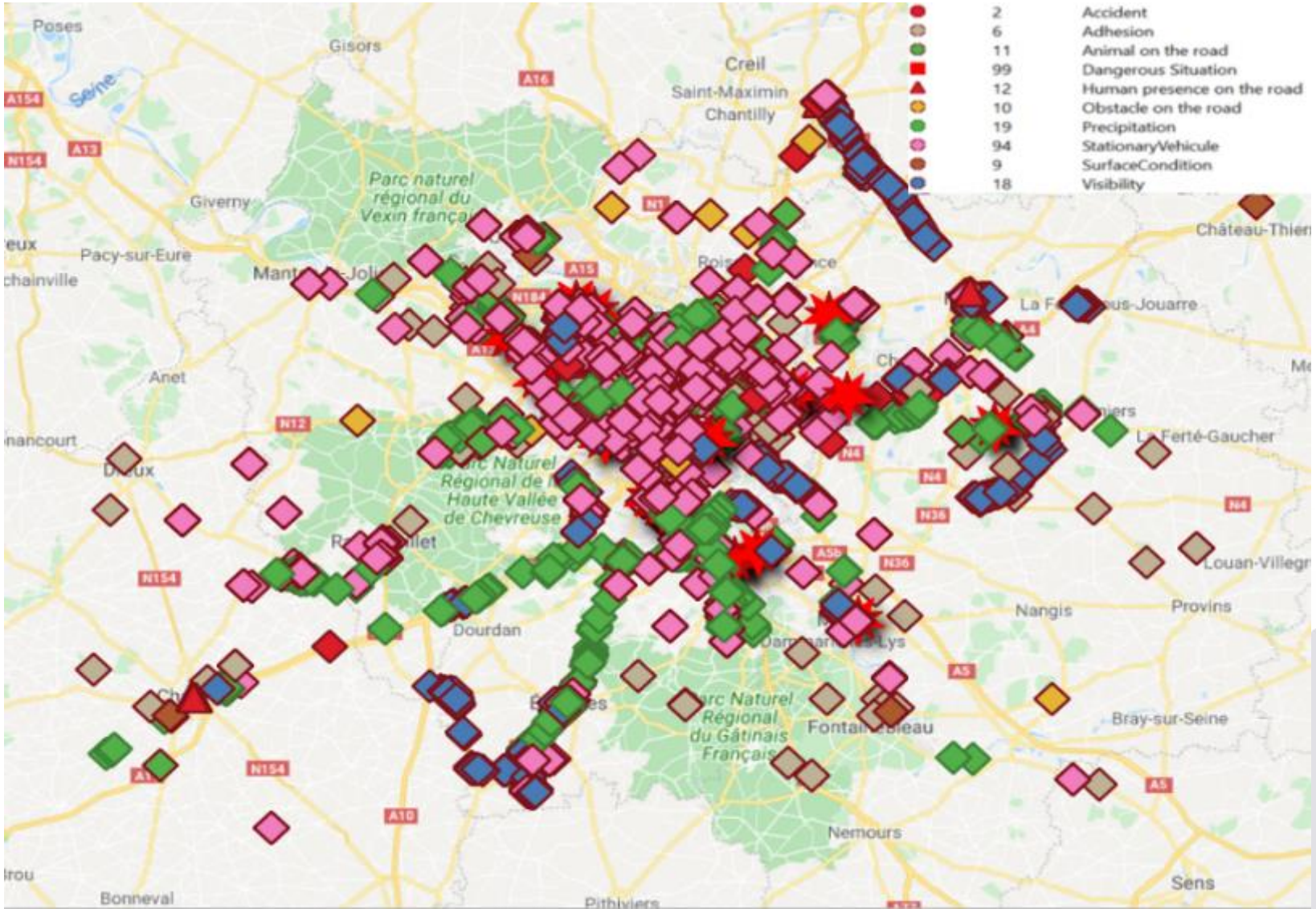

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Event map sent by V-ITSS

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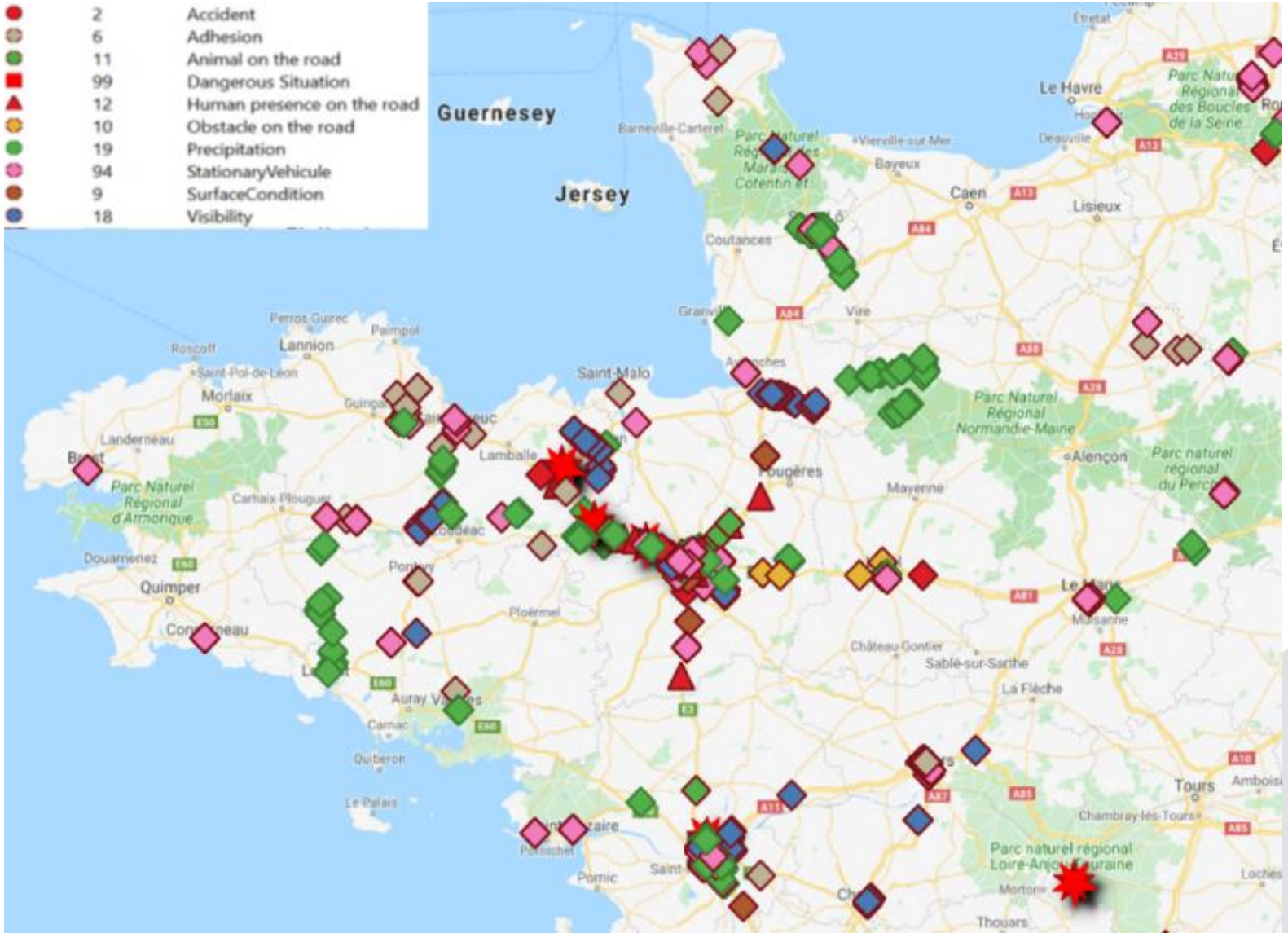

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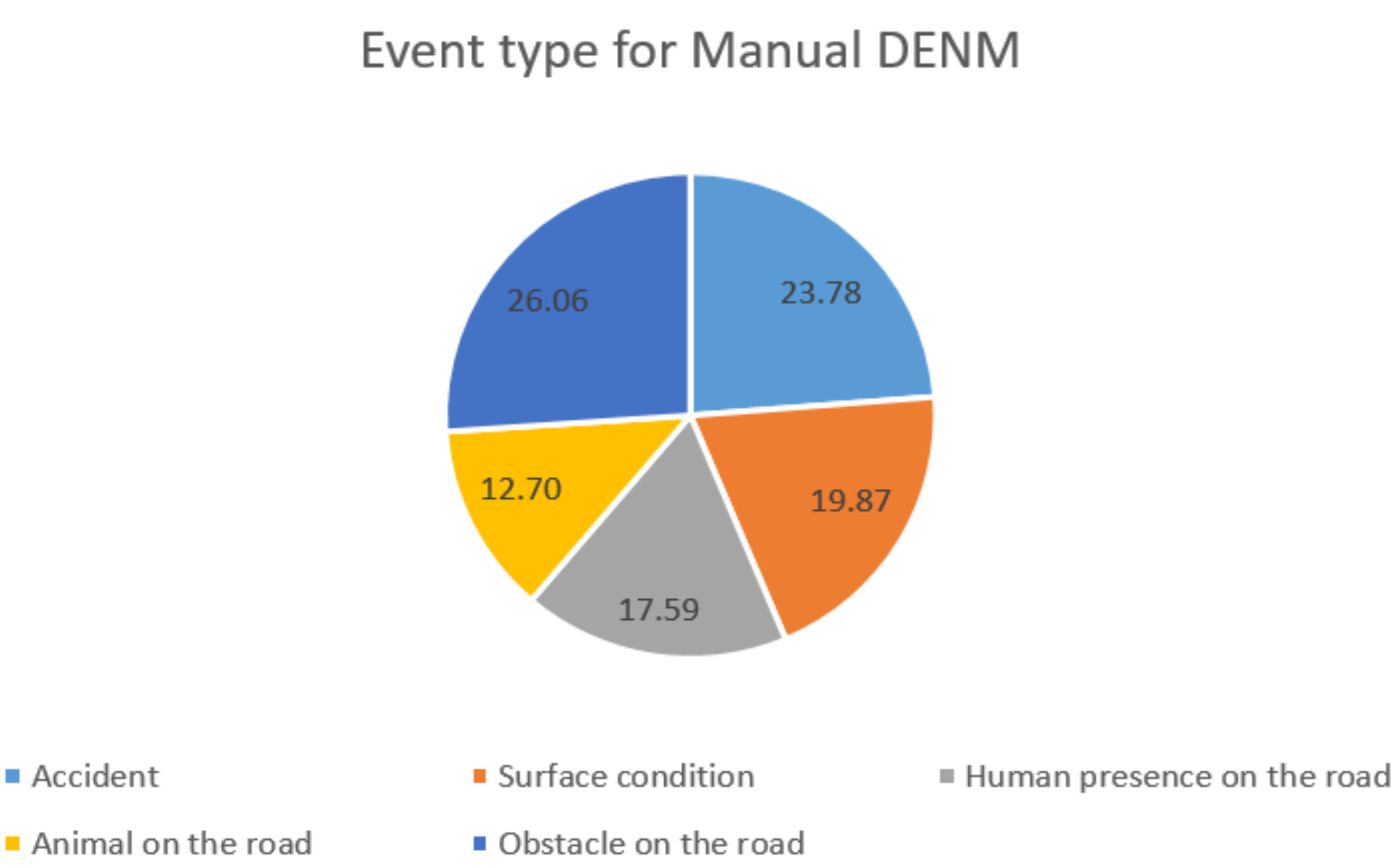
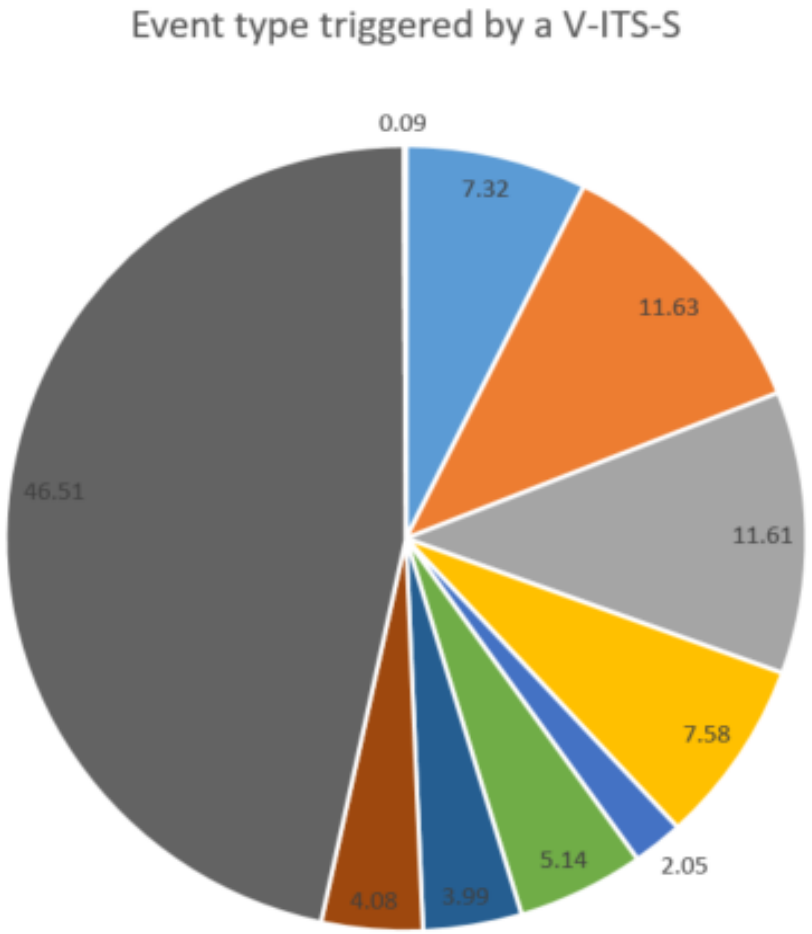
Events sent by vehicles





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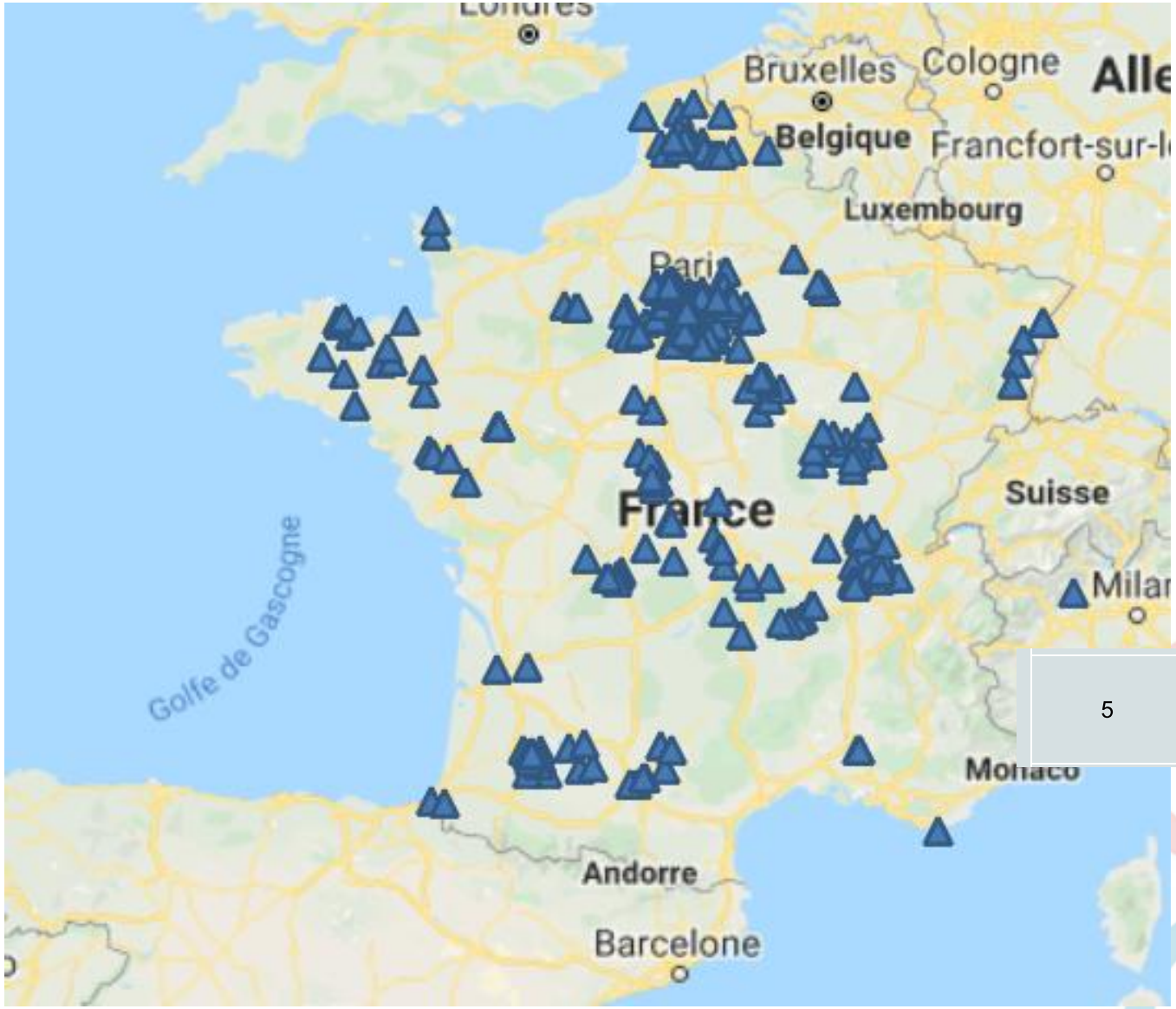
Slippery road



- Slippery road use cases automatically triggered by V-ITSS with an information quality of 5

5	[ASR request >200 ms + accelerator pressure <30% of max during activation of the ASR] OR [ABS action + brake pressure <20% of max]

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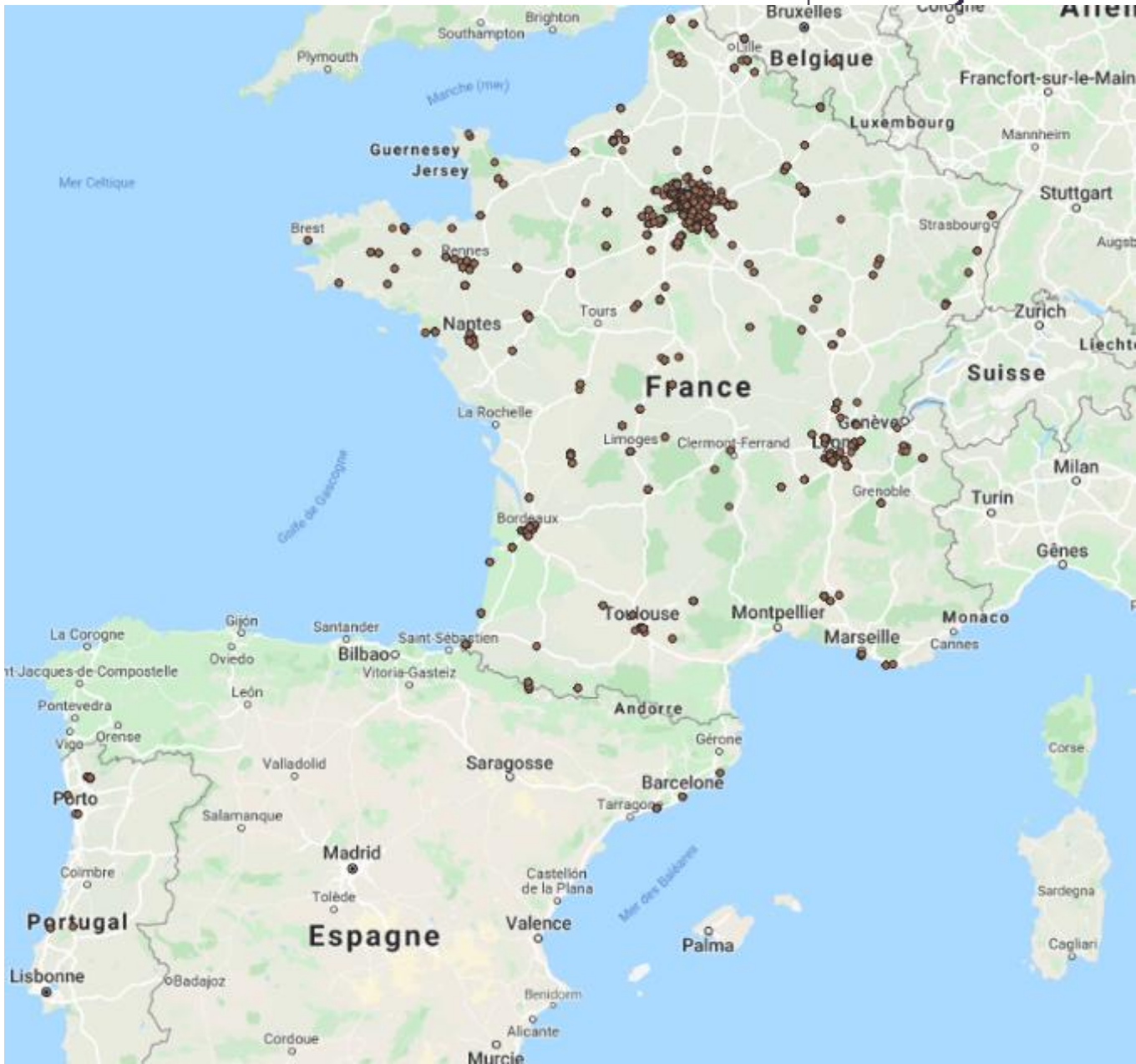
Stationary vehicle

Stationary vehicle, breakdown	94 : Stationary vehicle	0 : Unavailable
Stationary vehicle, breakdown	94 : Stationary vehicle	2 : Vehicle breakdown
Unprotected accident area	94 : Stationary vehicle	3 : Postcrash



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Zoom sur Stationnary vehicle – vehicle breakdown

actionid_originatingstationid	actionid_sequencenumber	eventtype_subcausecode	informationquality
4266758583	1	2	2
140176431	1	2	3
140176431	1	2	2
140176431	1	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	2	2	2
140176431	3	2	3

2	Warning since 20s + Breakdown message on the instrument panel + V=0 since 20s + [Neutral since 3s OR parking brake since 3s OR Brake activated since 3s OR seat belt unbuckled since 3s]	Risk of non-immobilising breakdown, especially for the case of a vehicle in neutral. Moreover, the driver may be in a stopped situation to perform a diagnosis and decide to start again if not immobilising
3	Warning + Breakdown message on the instrument panel + V=0 + [door open during at least 3s OR IGN=OFF since 3s]	

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Stationary vehicle - Postcrash

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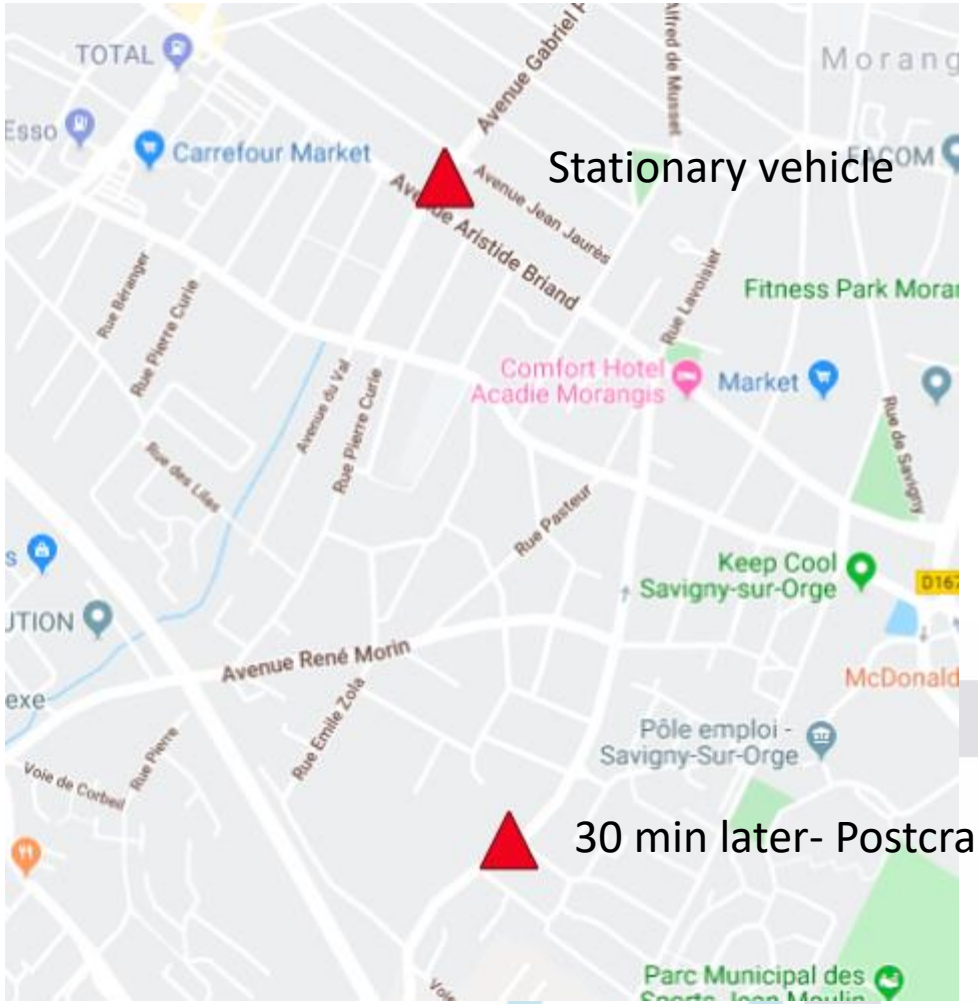
actionid_originatingstationid	actionid_sequencenumber	eventtype_subcausecode	informationquality	eventposition_latitude	eventposition_longitude
4148213900	2	3	1	48.6911183	2.327403

1	V=0 + manual E-call (or emergency button for ITSS-Vg) + 15s max between the 2 conditions	Vehicle stopped for a reason other than an accident (assault, passenger discomfort) and E-Call



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Stationary vehicle

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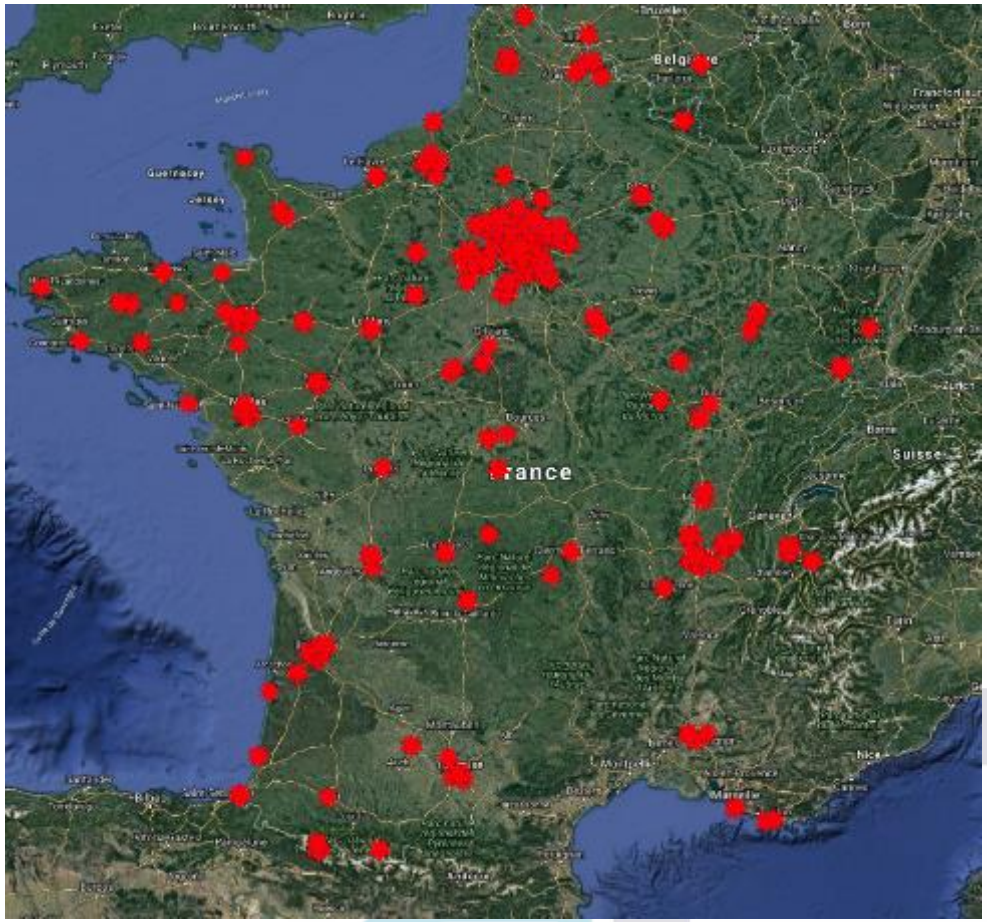
A2-D4a Warning stationary vehicle	1	Warning + V=0 since 30s	Risk of traffic jam without data on the vehicle's position (lane or shoulder)
	2	Warning + V=0 since 30s (can be reduced to 20s if enough triggering conditions) + [Neutral OR parking brake OR seat belt unbuckled]	Risk of traffic jam without data on the vehicle's position (lane or shoulder), for the case of the vehicle in neutral
	3	Warning + V=0 since 30s (can be reduced to 0 s if enough triggering conditions) + [door open during at least 3s OR -APC]	



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Out of 1635 events, 1346 CC94 0 with IQ=3

-> Are the triggering conditions relevant for all events?

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Faulty messages

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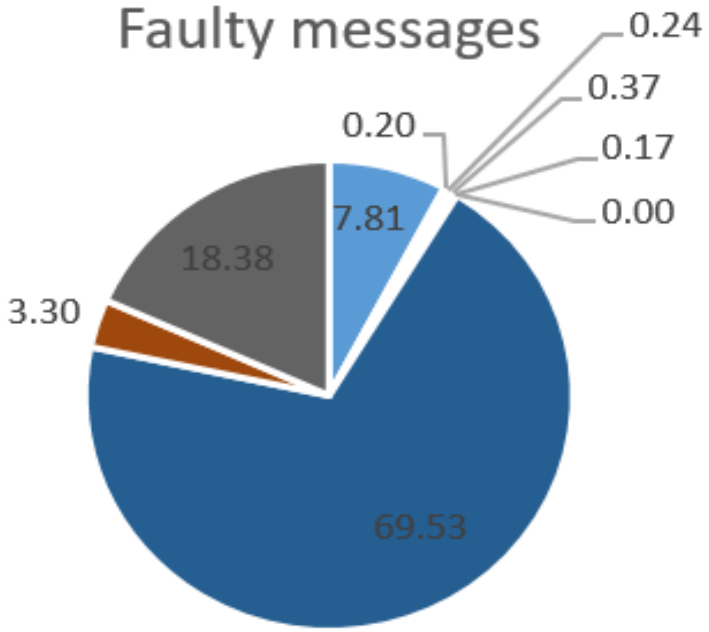
Number of Faulty message : **1 159 033**



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- CAM: SSP non valid
- DENM: SSP non valid
- DENM: DENM out of date
- DENM: UPER decoding error
- Geonet: Destination too far
- Geonet: Protocol version unsupported
- Geonet: Non secured packet while security is activated
- Geonet : duplicate adress on multi hop packet
- Geonet: Insupported BTP port

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Conclusion

- + more than 14 Millions lines with an average of 10 different data
- Performances:
  - An average of 300 ms latency between notification and reception at facilities for V2I and almost 500 ms for CAM reception (in line with standards)
  - In straight line R-ITSS range of more than 1500m
  - Sometimes a limited range due to the environment but positioned to reach a maximum number of vehicles
- The conditions for triggering use cases like 'stationary vehicle' deserve to be re-examined
- Users rarely use the HMI to report an event -> automatic events should be the only possible way to ensure safe use for the driver and relevant information for others drivers or road operateur

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Questions / answers

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Cross-tests and European harmonization

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Cross-tests

Jose Fernandez, CTAG
Jorge Ribeiro, A-to-Be
Lara Moura, A-to-Be

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Summary

- Why Xtests in SCOOP?
- Goal and main tasks
- 1st Wave test recap - Focus on ITS-G5
- 2nd Wave test highlights - Hybrid Approach
  - Main goals
  - Technical approach
  - On lab
  - On road
- Lessons learned…

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Why Xtests in SCOOP?

What is **C-ITS**?

C-ITS is a **process of communication and data sharing** between components of transport systems - such as vehicles, infrastructure and pedestrians - which can be used to avoid collisions, reduce vehicle emissions and enable traffic to operate more efficiently.

What does **interoperability** mean in C-ITS context?

System ability to provide data to and accept data from other systems so these **data exchanges make possible an effective joint operation.**

What does EC says on all this?

EU standardization mandate M/453

Invitation to European Standardization Organizations (ETSI, CEN, CENELEC) to prepare a coherent set of standards, specifications and guidelines to support European Community wide implementation and deployment of C-ITS as **it is necessary to ensure interoperability among the different systems to take full advantage of the benefits that C-ITS based systems and applications can bring to the transport sector.**

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Goal and main tasks

- **Check how interoperable SCOOP@F system is with other existing C-ITS implementations (Austria, Spain, Portugal) both for ETSI ITS G5 and cellular based communications (two test phases, W1 and W2)**
  - Comparison of specifications
  - Selection of common services to be cross-tested
  - Organization and execution of Xtests
  - Report on results and conclusions

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SCOOP Part 2 Partners

French:

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sanef

PSA PEUGEOT CITROËN
PEUGEOT CITROËN

RENAULT

orange™

Cerema

IDNOMIC

IFSTTAR

Portuguese:

IMT INSTITUTO DA MOBILIDADE E DOS TRANSPORTES, I.P.

Brisa CONCESSÃO

A-to-Be Powered by Brisa

Infraestruturas de Portugal

norte litoral

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Spanish:

GOBIERNO DE ESPAÑA | MINISTERIO DEL INTERIOR

DGT Dirección General de Tráfico

CTAG

Austrian partners:

ASFINAG

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Use Cases

Use Cases selected:

- *CAM aggregation*
- *Obstacle on the road*
- *Animal/Person on the road*
- *Adverse weather conditions*
- *Planned road works*

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1st Wave test recap – Focus on ITS-G5

Cross border test in Vigo SP/PT/FR - 12/2017

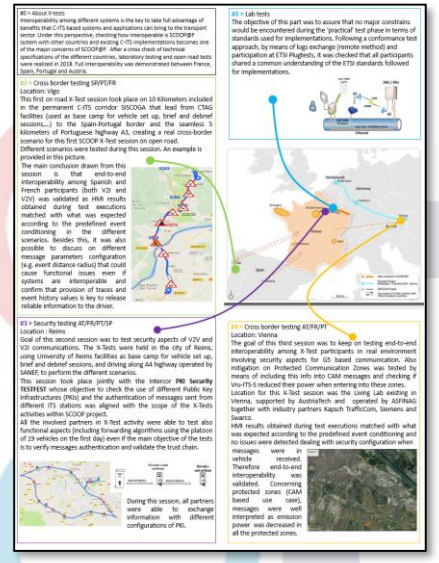
- Validate V2V and V2I communications

Security test in Reims AT/FR/PT/SP - 04/2018

- Validate the security infrastructure (PKI)
- Validate the authentication of messages sent from different ITS stations

Cross border test in Vienna AT/FR/PT - 07/2018

- Validate the systems interoperability including security
- Inclusion of protected zones where the emission power is decreased



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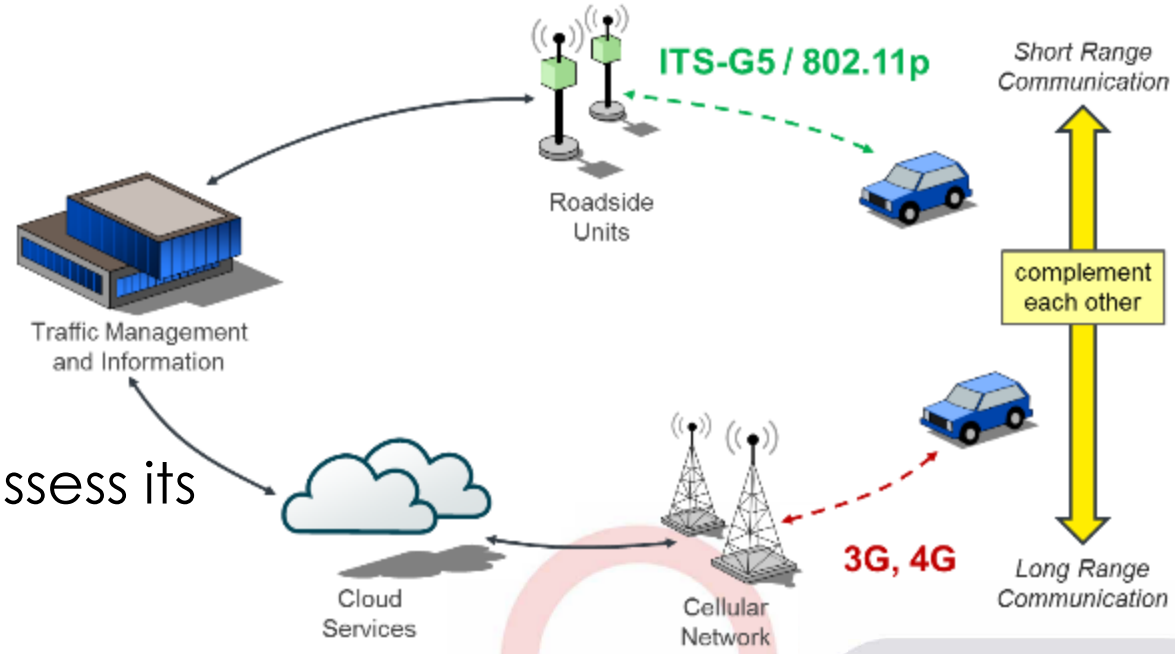
2nd Wave test highlights – Main goals

Hybrid communication:

- Coupling short and long range communications
- Larger coverage
- Able to reach non ITS-G5 vehicles
- Different country architectures to assess its viability in the long term



- short range : BTP/geonet/ITS-G5
- long range : IP/cellular or IP/ITS-G5

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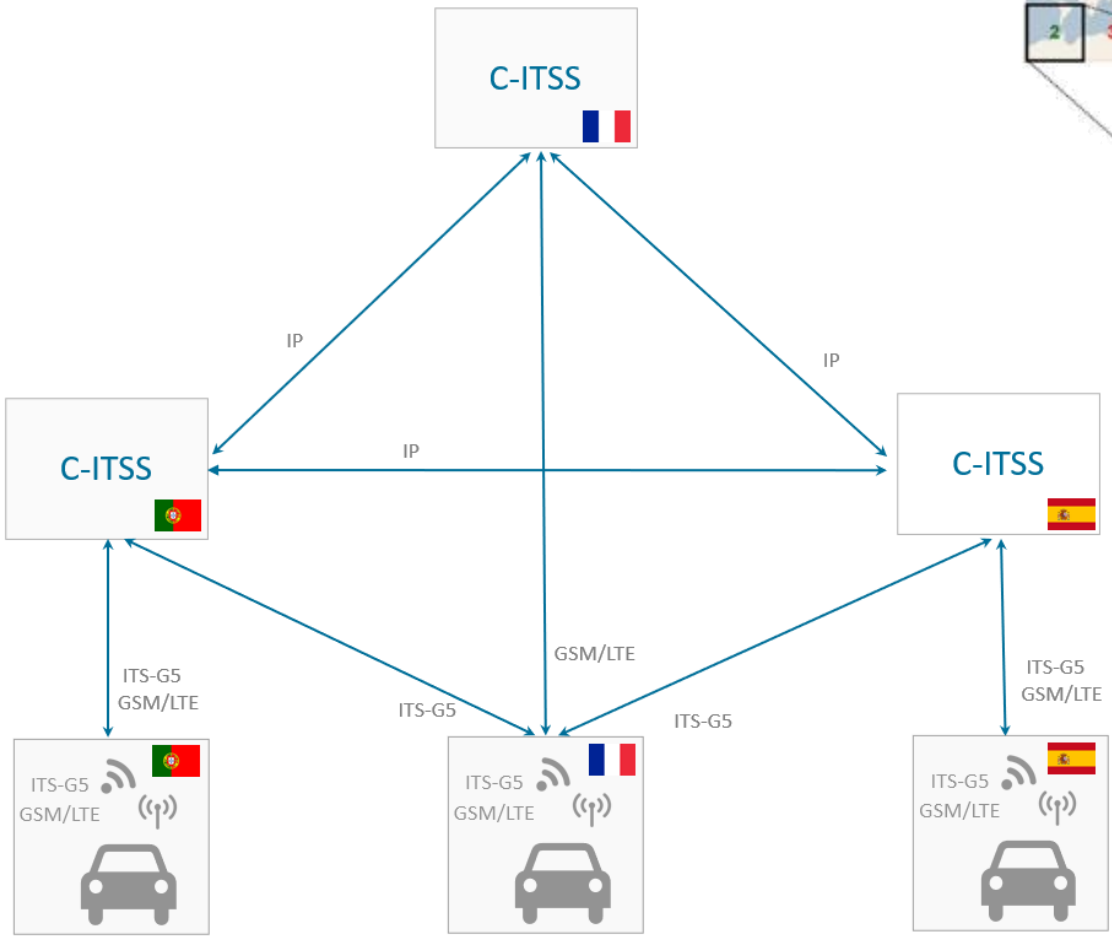
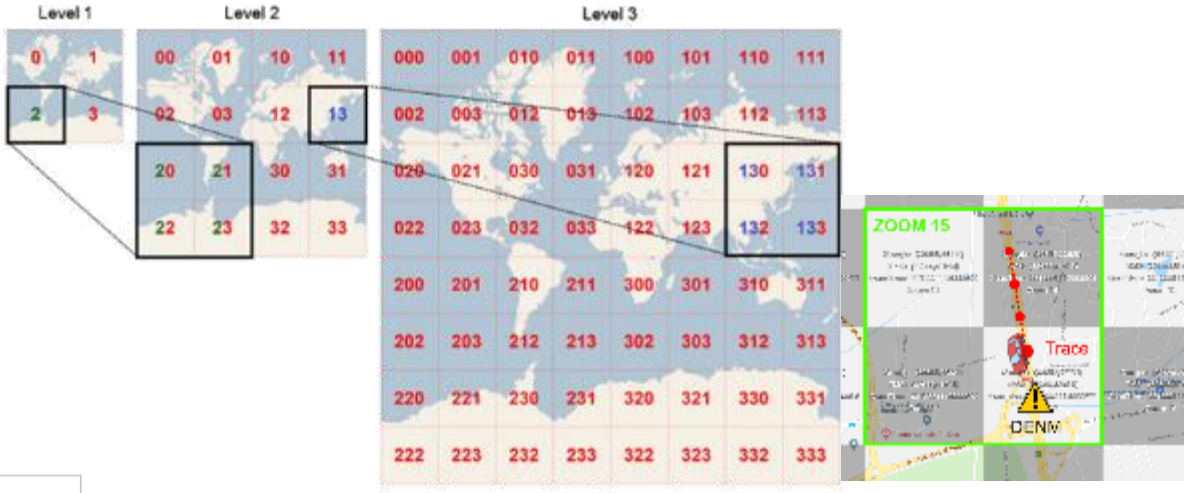
2nd Wave test highlights - Technical approach (I)





Achievements:

- Connect three National C-ITSS following InterCor and C-Roads approaches
- Interchange V2V/V2I events through cellular and ITS-G5
- Backend interoperability reached using:
  - AMQP protocol
  - ETSI C-ITS messages as payload
  - Geographic broadcasts based on tiles with different zoom levels

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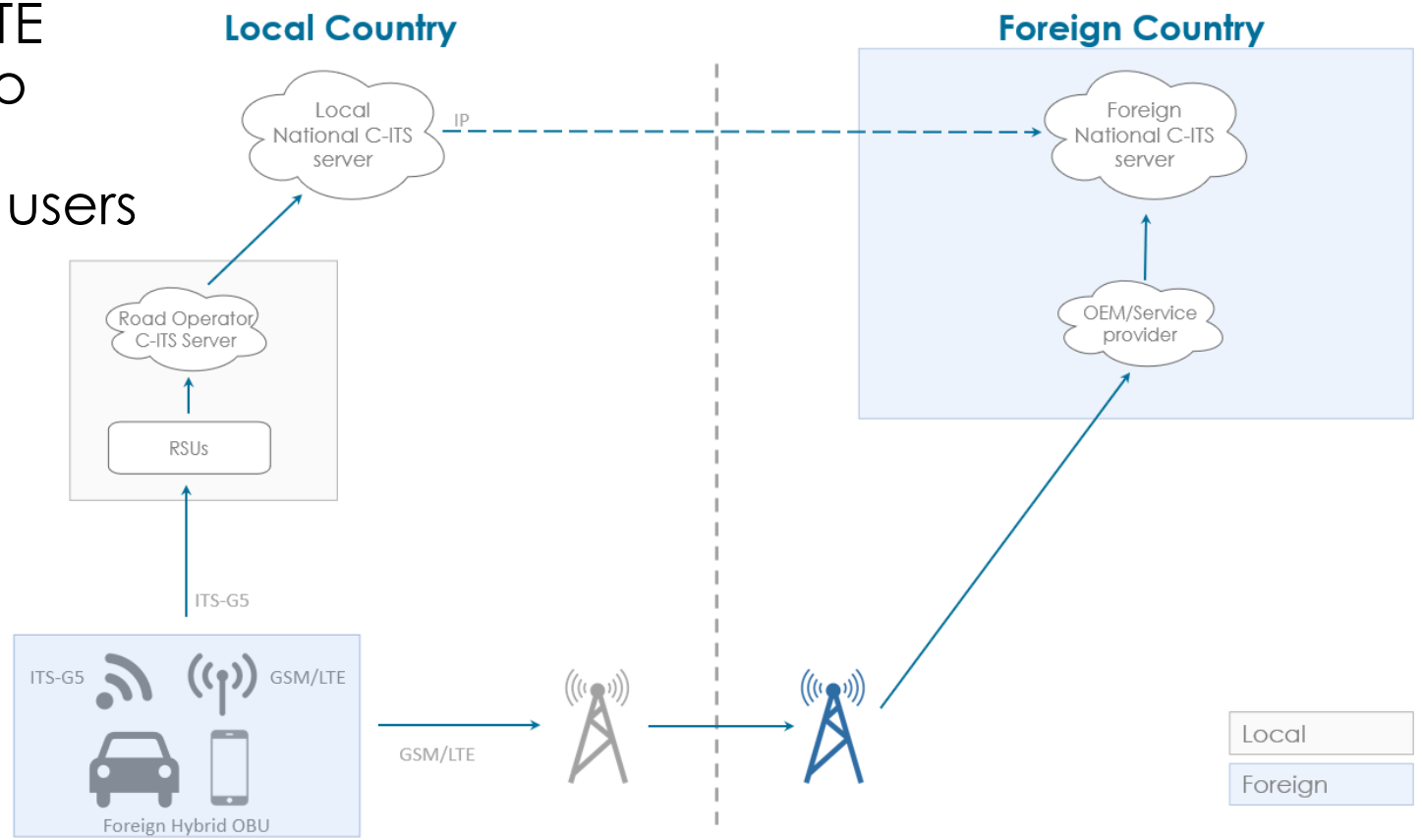
2nd Wave test highlights - Technical approach (II)

Event reporting example:

- Foreign vehicle reports an event
- Event follows ITS-G5 and GSM / LTE
- Road operators forward events to subscribers
- Subscribers can forward to other users



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2nd Wave test highlights - On lab

- **Objective:** to assure that basic data communication between road-side units and on-board equipment (W1) and among backends (W2) work correctly.
- Conformance test 'spirit': to check that all partners share a common understanding of the ETSI standards and protocols followed for implementations.
- **Procedures:** Analysis of logs exchange (remote method), participation at ETSI Plug test.
- Interoperability validated at Networking and Facilities layer levels in terms of message format and also possible to detect and solve 'primary' issues at message content level for On Road Tests (e.g. DENM code and cause codes).

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2nd Wave test highlights – On road (I)

- **Objective:** Check functional end-to-end interoperability between relevant participants in real environments.
- Monitoring of conformance parameters to detect interoperable but not functional cases.
- **Procedures:** Execution of Xtest scenarios (controlled and naturalistic)->Analysis of logs in case of discrepancies with expected results (i.e. HMI expected behaviour)
- Three steps approach to finally validate C-ITS hybrid implementations:
  - ETSI ITS G5 without security layer (Vigo (ES)-North Portugal (PT), December '17)
  - ETSI ITS G5 with security layer (Reims (FR), April '18; Vienna (AT), June'18)
  - ETSI ITS G5 with security layer + cellular (Vigo (ES)-North Portugal (PT), July '19)

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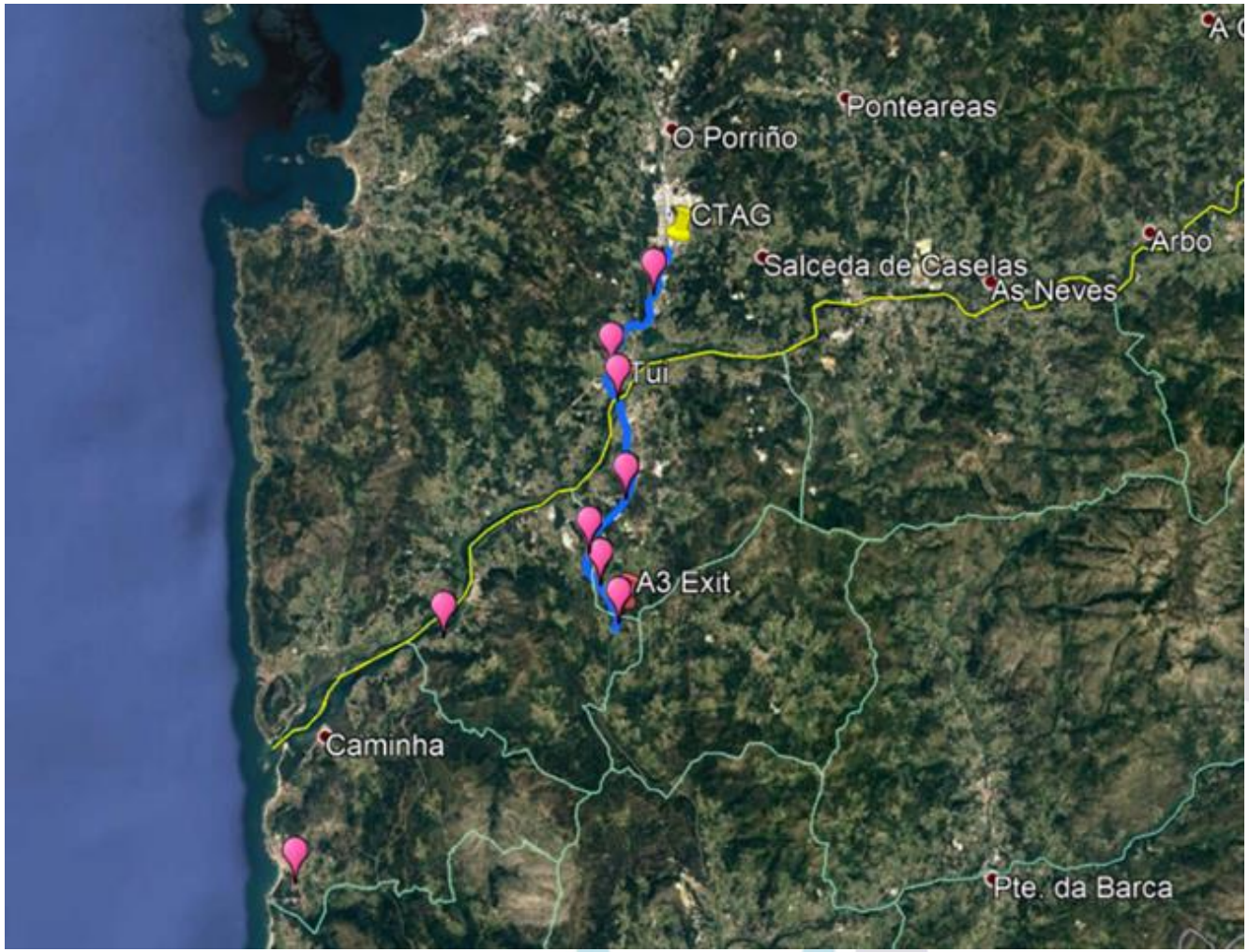
2nd Wave test highlights – On road (II)

Road side equipment

- 10 ITS-G5 road side units

Number	Location	Provider
1	42.0819°, -8.6295°	CTAG
2	42.0469°, -8.6568°	CTAG
3	42.0317°, -8.6525°	IP
4	41.9196°, -8.7631°	IP
5	41.6500°, -8.7751°	IP
6	41.8039°, -8.8563°	IP
7	41.9852°, -8.6475°	A-to-Be
8	41.9598°, -8.6709°	A-to-Be
9	41.9446°, -8.6637°	A-to-Be
10	41.9264°, -8.6521°	A-to-Be



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2nd Wave test highlights – On road (III)

Connected vehicles

- 6 vehicles from different partners

CTAG, A-to-Be, IP, URCA, RSA, PSA

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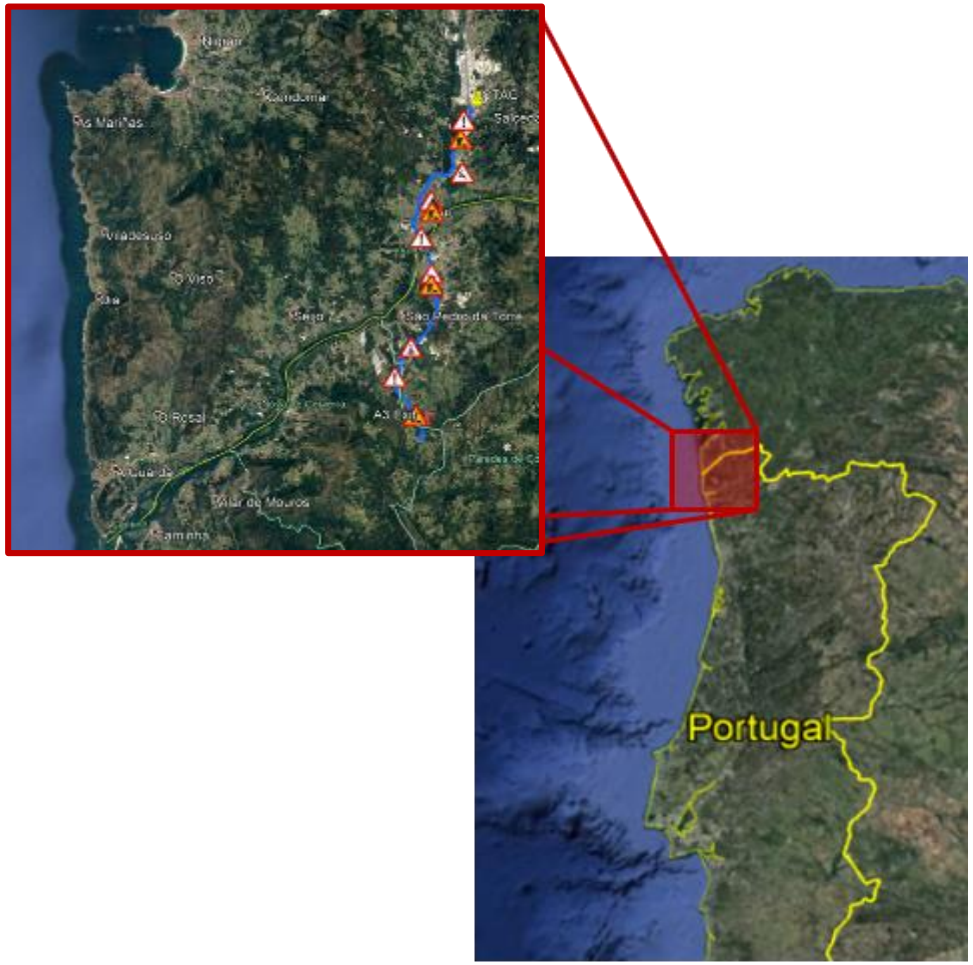
2nd Wave test highlights – On road (VI)

Result summary

- Almost every event was interchanged



Event	Direction	Provider	Location
DENM 10/0	I2V	A-to-Be	Portugal
DENM 18/1	I2V	A-to-Be	Portugal
DENM 3/3	I2V	A-to-Be	Portugal
DENM 11/0	I2V	IP	Portugal
DENM 3/0	I2V	CTAG	Spain
DENM 11/0	I2V	CTAG	Spain
DENM 10/0	I2V	CTAG	Spain
IVIM BEGIN	I2V	CTAG	Spain
IVIM END	I2V	CTAG	Spain
DENM 3/3	I2V	URCA	Portugal
DENM 3/3	I2V	URCA	Spain
DENM 3/0	I2V	URCA	Spain
DENM 17/0	I2V	URCA	Portugal
DENM 12/0	V2V	A-to-Be	Portugal
DENM 12/0	V2V	A-to-Be	Portugal
DENM 12/0	V2V	A-to-Be	Spain
DENM 11/0	V2V	PSA	Portugal
DENM 94/0	V2V	RSA	Spain

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2nd Wave test highlights – On road (V)

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Lessons learned…

- SCOOP's interoperability validated between the partners
- Established a trust relationship among PKIs (at RCAs level) deployed by X-Tests partners in order to create a (project specific) global trust domain
  - Governance of an interoperable and a global PKI for a European wide C-ITS security Credential Management system
  - Interoperability and backward compatibility among potential co-existing security standards
- In cellular roaming, observed delays when handover between countries occur
- Multiple hybrid communications solutions that serve as input for other projects (Intercor, C-ROADS, etc.)
- Dealing with interoperability issues at international level is necessary for a successful and optimal C-ITS deployment.

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The C-Roads Platform

Eric OLLINGER, MTES

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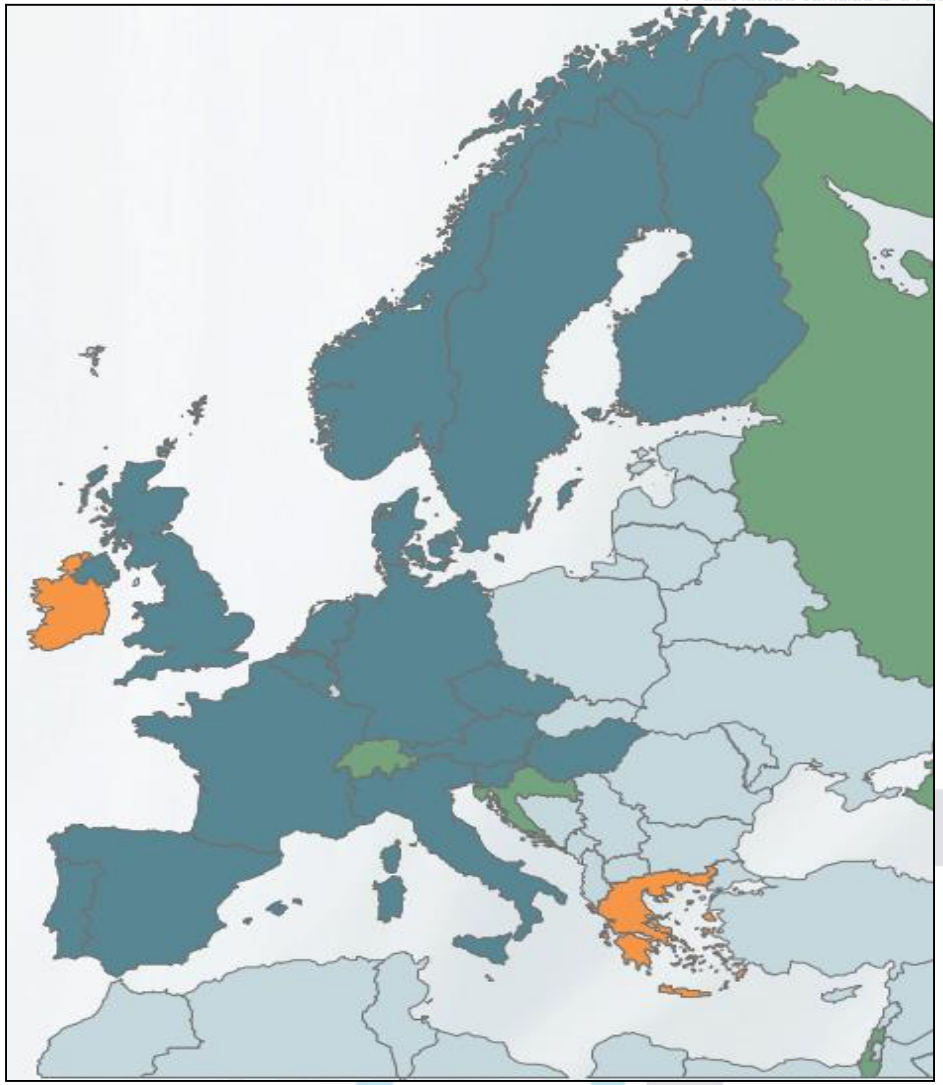
A platform of 18 Member States

- Launched end of 2016
- Initial members : France, Germany, the UK, the Netherlands, Belgium/Flanders, Austria, Slovenia, Czech Republic
- Joined in 2017 by Italy, Spain, Portugal, Belgium/Wallonia, Denmark, Sweden, Norway, Finland, Hungary
- Joined in 2019 by Ireland and Greece



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Deploying C-ITS

Through pilot deployment projects funded by the Connecting Europe Facility

SCOOP is associated

The Member States (National Road Authorities) are representing the projects

By 2020:

- 6000 km covered with ITS G5
- 100 000 km covered with cellular communications

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A focus on Day 1 services

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Working together

- A Steering Committee, chaired by France
- WG1 : Organisational aspects, chaired by the Czech Republic
- WG2 : Technical aspects, chaired by France
  - TF1 : Security, chaired by Germany
  - TF2 : Functional specs, chaired by the Netherlands
  - TF3 : Technical specs, chaired by Austria
  - TF4 : Hybrid, chaired by Sweden
  - TF5 : Validation, chaired by France
- WG3 : Evaluation, chaired by Italy
- WG4 : Urban, chaired by Portugal
- WG5 : Digital Transport Infrastructure, under construction

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Doing cross-site testing

- Ex. SCOOP cross-tests / InterCor TESTFESTS in Reims, April 2018
  - Testing secure exchange of messages cross-borders
  - 144 people from 11 countries
  - 22 OBUs, 12 RSUs
  - A 23 km loop with 9 events

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MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE ET SOLIDAIRE

MINISTÈRE CHARGÉ DES TRANSPORTS

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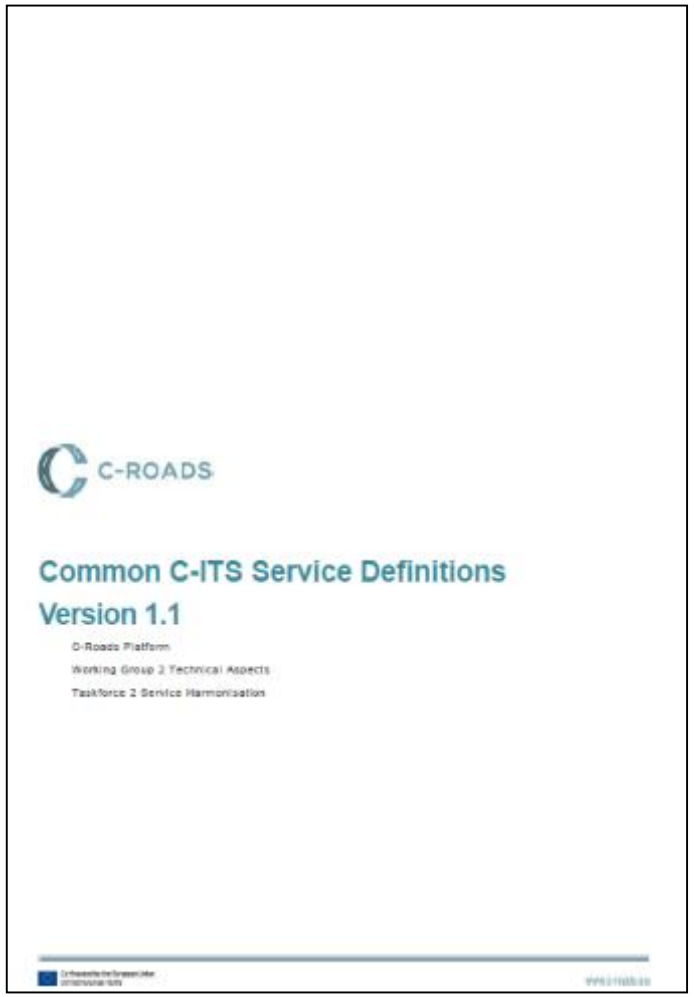
Harmonizing specs


C-ROADS

Common C-ITS Service Definitions

Version 1.1

C-Roads Platform

Working Group 1 Technical Aspects

Taskforce 1 Service Harmonisation

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4.2 RWW: Use Cases

4.2.1 RWW: Lane closure (and other restrictions) (RWW – LC)

RWW – LC: Lane Closure and other restrictions	
Type of road network	All
Type of vehicle	All
Use case introduction	
Summary	• The road user receives information about the closure of part of a lane, whole lane or several lanes (including hard shoulder), but without the road closure. • The closure is due to a static road works site. • In this use case, alternate mode and road closure are excluded.
Background / added values	Currently, many road users enter the road works sites or strike the protection equipment of the site, sometimes causing victims. Information sufficiently in advance would prevent this type of situation by adapting the behaviour of the road user.
Objective	• The objective is to allow road users to anticipate the closure of lanes due to a road works site on the road ahead and to adapt their speed and lane on the road. • The objective is not to signal a road closure and therefore no alternative route will be transmitted, even if a warning message could be sent. It is also not the objective to signal to the user that he/she is likely to have to stop, as in the case of an alternate mode.
Desired behaviour	• Increased vigilance • Adaptation of the speed • Change of lanes (if needed)
Expected benefits	• Reduce the risk and number of accidents and dangerous situations for road users and workers. • Informing the road user about a risk of discomfort on the road (slowing down, manoeuvring) • Improved traffic management due to less traffic relevant events on the road
Use case description	
Situation	• Roadworks equipped with warning beacons / temporary road signs / illuminated lights arrows,, on a road with separate carriageways or on a dual carriageway. • Carriageway crossover (in a divided highway. situation where vehicles need to use the contraflow carriageway because their own carriageway is closed) • Lane closure by sign gantries (line control system) • Lane closure by warning trailer equipped with RSU (short term roadworks)
Logic of transmission	I2V Broadcast
	• The Road operator is the origin of the information of the message. It can be the Traffic Operations Center, or a road operator vehicle if no connection to the central station

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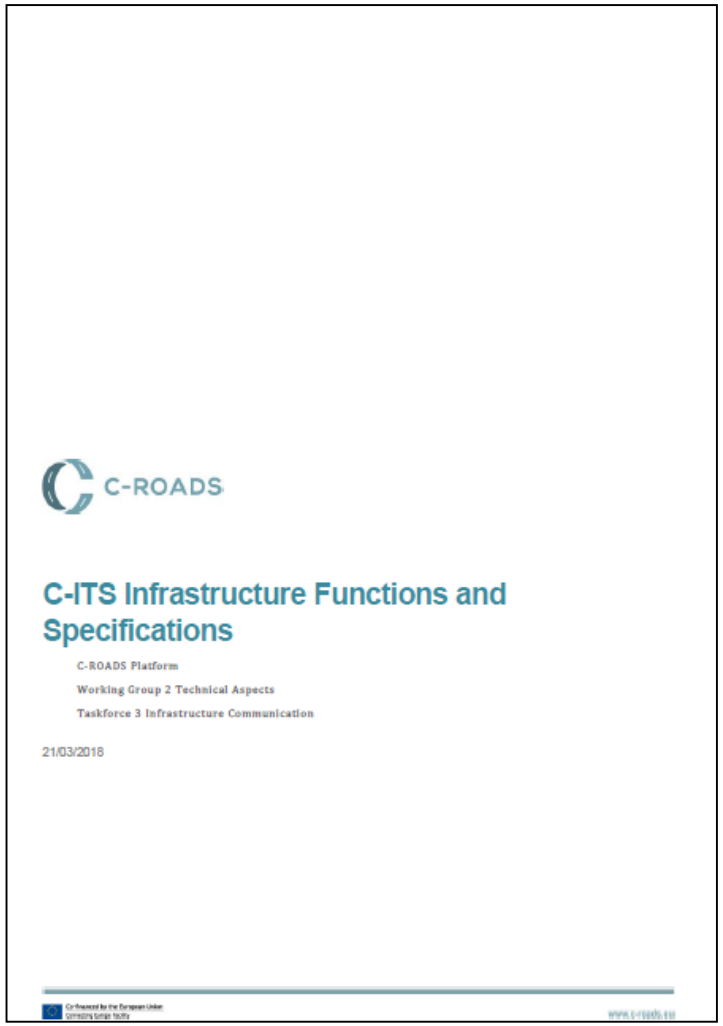

3.1.2 Infrastructure to Vehicle Information (IVI) Service

"IVI service is one instantiation of the infrastructure services to manage the generation, transmission and reception of the IVIM messages. An IVIM supports mandatory and advisory road signage such as contextual speeds and road works warnings. IVIM either provides information of physical road signs such as static or variable road signs, virtual signs or road works" (ETSI 103 301) [17].

The I-VI service instantiated in an ITS-Station shall provide either the transmission or the reception service.

Four types of IVIMs are generated by the IVI services:

- **new** IVIM
- **update** IVIM
- **cancellation** IVIM and
- **negation** IVIM.

"The type of the IVI to be generated upon an application request" (ETSI 103 301) [17].

The header of IVIM shall be as specified in the data dictionary ETSI TS 102 894-2 [16].

The data elements of the IVIM message payload are defined in CEN ISO/TS 19321 [18].

Data elements, data frames and service parameters shall be used according to the definitions in tables Table *9* and Table *10*.

Table 9 IVIM elements in general

Name	Type	Mult i.	Common Usage	Specific Usage
IVI ManagementContainer		1		
serviceProviderId	DE	1	It identifies the organisation that provided the IVI, containing a country code according to ISO 3166-1 and ISO 14816 and a provider identifier.	
ivIdentificationNumber	DE	1	This DE is the identifier of the IVI Structure, as assigned by the Service Provider. This component serves as the ID of the message per serviceProvider and can be used by other related messages as a reference.	
timestamp	DE	1 [0..1]	This DE is the timestamp representing the time at which the IVI message is generated or when the last content change of the messages had occurred.	
validFrom	DE	1 [0..1]	This component may hold the start time of the validity period of the message. If start time is unknown to the system, validFrom is not present or equal to timestamp.	
validTo	DE	1	End time of the validity period of the message	

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Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

Committed

- To use the harmonized specs in their pilot deployment projects
- To achieve a series of milestones towards harmonized deployment of C-ITS in Europe

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Cooperating

- Associate Members : Switzerland, Croatia, Turkey, Israel, Russia, Australia, New Zealand
- with the Car2Car Communication Consortium to harmonize specs
- with ASECAP to work on coexistence with tolling DSRC
- with Datex II PSA for the link with TMCs
- with EU-EIP for the link with ITS

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Demonstrating interoperability

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- C-ITS Roadshow at the FISITA congress, Prague, 15-18 September 2020

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Questions / answers

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Tonight

- Gala dinner: 19h at château Grattequina, including tasting of Bordeaux wine

- Departure by bus 18h30
- Return by bus to Bordeaux city center and L'Agora

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