C-MOBILE

Accelerating C-ITS Mobility Innovation and deployment in Europe

D4.1: Training materials on C-ITS for professional drivers

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Main authors	Oleh Shchuryk (IRU Projects) Jacint Castells (IDIADA) André Perpey (NeoGLS) Olatz Iparraguirre (CEIT) Jos van Vlerken (CPH) Tamara Goldsteen (HLM) Simon Edwards (UNEW) Areti Kotsi (CERTH) Pablo Mejuto (CTAG)
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Project coordination

Mr. Alex Vallejo
Applus+ IDIADA
PO Box 20 Santa Oliva
43710, L'Albornar, Tarragona
Spain

Telephone: +34 977 18 93 60
E-mail: alex.vallejo@idiada.com

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Abbreviations

Abbreviation	Definition
3G	3rd generation of mobile telecommunications technology
ABS	Anti-lock Braking System
ACC	Adaptable Cruise Control
ADAS	Advanced Driver Assistance System
AEB	Automatic Emergency Braking
ATIS	Advanced Traveller Information System
BLIS	Blind Spot Information System
CACC	Cooperative Adaptable Cruise Control
CCC	Conventional Cruise Control
CEN	European Committee for Standardisation (*Fr.*: Comité Européen de Normalisation)
C-ITS	Cooperative Intelligent Transport System
CPC	Certificate of Professional Competence
DENM	Decentralised Environmental Notification Message
DSRC	Dedicated Short Range Communication
DTM	Dynamic Traffic Management
EBA	Emergency Brake Assist
EC	European Commission
e-CMR	Electronic Consignment Note
ECU	Electronic Control Unit
EP	European Parliament
ESS	Emergency Stop Signal
EVA	Emergency Vehicle Alert
FCD	Float Car Data
I2V	Infrastructure-to-Vehicle
iTLC	Intelligent Traffic Light Controller
ISA	Intelligent Sped Assistance
IVI	In-Vehicle Information
IVS	In-Vehicle Signage
GA	Grant Agreement
GLOSA	Green Light Optimal Speed Advisory
GPS	Global Positioning System
HGV	Heavy Goods Vehicle
LCV	Light Commercial Vehicle
LDW	Lane Departure Warning
LIDAR	Light Detection and Ranging
LGS	Lane Guard System
MSD	Minimum Set of Data
NST	Non-stop Truck
OBU	On-board Unit
OEM	Original Equipment Manufacturer
PKI	Public Key Infrastructure
PO	Project Officer
PSAP	Public Answering Points
PVD	Probe Vehicle Data
RDS	Radio Data System
RHS	Road Hazard Signalling
RLVW	Red Light Violation Warning
RSU	Roadside Unit
RTTI	Real-Time Travel and Traffic Information
RWW	Road Work Warning
SAS	Speed Alert System
SPAT	Signal Phase and Timing
SPATEM	Signal Phase and Timing Extended Message

TMC	Traffic Message Channel
URI	Uniform Resource Identifier
V2V	Vehicle-to-vehicle
V2X	Vehicle-to-Everything
V-ITS-S	In-vehicle ITS Station
VMS	Variable Message Signs
VRU	Vulnerable Road Users
VSL	Variable Speed Limit
WAVE	Wireless Access in Vehicular Environments

Executive Summary

In the past years, there has been tremendous progress in the field of intelligent transport systems; several successful cooperative mobility projects have proven potential benefits of cooperative systems in increasing both energy efficiency and safety for specific transport modes. However, the large variety of cooperative applications have been designed for different goals, stakeholders or specific settings / environments and have been developed on a silo-based approach and deployed independently from each other, serving however, at higher level, similar goals and functionalities for the end-user. Scalability, IT-security, decentralization and operator openness are some of the most important properties that a technical and commercial successful solution must provide.

C-MobILE aims to stimulate / push existing and new pilot sites towards large-scale, real-life C-ITS deployments interoperable across Europe. Well-defined operational procedures will lead to decentralized and dynamic coupling of systems, services and stakeholders across national and organizational borders in an open, but secure C-ITS ecosystem, based on different access technologies, the usage of which is transparent for service providers and seamless and continuous for the end-users across different transport modes, environments and countries.

This deliverable brings together all training materials that were prepared and used by the project partners to provide trainings for professional drivers and fleet managers in the eight C-MobILE deployment sites. The deliverable briefly describes the existing training methods and techniques that aim to transfer the knowledge to the participants, presenting six groups of training methods. The document not only enumerates the methods, but it suggests the best combination of methods to be used in C-MobILE trainings to achieve the most desirable and possible results. It focuses on so called “blended learning approach.” Then it presents a structure of the C-MobILE training programme that consists of four main modules, i.e. theoretical module, deployment sites C-ITS services module, practical module and knowledge test module. C-MobILE has also designed an additional module on Smart Tachograph. It is briefly described in the deliverable although it was not included in all deployment sites trainings due to the relevance of this topic for the trained audience.

1. Introduction

1.1. C-MobILE at a glance

The C-MobILE (Accelerating C-ITS Mobility Innovation and deployment in Europe) vision is a fully safe and efficient road transport without casualties and serious injuries on European roads, in particular in complex urban areas and for Vulnerable Road Users. We envision a congestion-free, sustainable and economically viable mobility, minimizing the environmental impact of road transport. C-MobILE will set the basis for large scale deployment in Europe, elevating research pilot sites to deployment locations of sustainable services that are supported by local authorities, using a common approach that ensures interoperability and seamless availability of services towards acceptable end user cost and positive business case for parties in the supply chain.

1.2. Objectives

The key objective of this deliverable is to collect and present the materials from eight deployment sites training activities that were organised for professional drivers and fleet managers to raise awareness and knowledge on the use of C-ITS services and their benefits for the users. Another main purpose of this document is to serve as a source of materials that can be reused in other future trainings organised by either project partners or any interested party that will contribute to a quick deployment of C-ITS services across Europe. The deliverable also provides a snapshot of existing training methods that can be exploited for providing such training. Furthermore, the proposed structure of the provided trainings in each deployment site can also serve as model for later trainings as it combines theory and practice which are essential not only to understand the principles of C-ITS but also to experience how services work in real conditions.

1.3. Targeted audience

The targeted audience of this deliverable are stakeholders and partners interested in using C-ITS services. As mentioned above, the main objective of this document is to be accessible to them and provide a training programme on ITS and C-ITS technologies and services. It also takes into account end-users and public authorities who will benefit from the trainings and will contribute to its further development as well as improvement. For this simple reason, the content is written in a clear for a large audience manner.

1.4. Document structure

The current deliverable is structured starting from a theoretical part of methods and techniques for trainings, followed by the methodology used in C-MobILE and finishing with a practical section with examples of the materials used in the Deployment Sites:

Section 2: 'A brief overview of existing training practices and methods' presents six groups of training methods and technics that are used to transfer the knowledge to the participants of any training. It also provides certain introduction to the various training concepts and some key terms.
Section 3: 'C-MobILE learning approach' describes the training methodology and technics used in C-MobILE trainings. It also presents a structure of the C-MobILE training programme that consists of four main modules: theoretical module, deployment site C-ITS services, practical module, knowledge test (plus additional, optional training).
Section 4: 'Deployment sites' presents eight deployment sites were the trainings were provided, focussing on their scope and benefits.
Section 5: 'Training materials' presents two training modules, namely theoretical and the knowledge test, which are common for each provided training. It also describes the materials that were used in these two modules.
Section 6: 'Deployment site training materials' provides materials used in the two other modules, namely deployment sites C-ITS services module and practical module. Since each deployment site focussed on different C-ITS services, this part of the deliverable consists of eight sub-sections dedicated to each deployment site of the project. It provides agendas, brief description of the purpose of the training, as well as the audience of each training.
Section 7: 'Conclusions' briefly summarises the document.

2. A brief overview of existing training methods and practices

A training aims to pass the knowledge to the participants and help them to retain information so that they can better do their work[1]. Hereby are presented some of the most common methods and their advantages and disadvantages. This section describes the traditional methods that remain effective as well as new practices that become increasingly prevalent as new technologies become more popular and easier to use.

The training methods are classified in the following six groups: classroom training; computer-based training (CBT); interactive method, experiential; online or e-learning methods and, finally, blended learning approach. In the following sub-sections all of them are explained with examples.

2.1. Classroom training

Classroom training or "instructor-led training" is the classical and the most popular technic to pass knowledge, which has various sub-types:

- **Blackboard method** the most "old-fashioned" method, but it is still effective, especially when trainees are to write on the board or ask for feedback on what is written on the board.
- **PowerPoint presentation** (PPP) is the most popular method that uses presentation software where the information is displayed on the screen. It can be combined with handouts and other interactive methods.
- **Storytelling** is the method in which a story is used as an example of wrong or right ways to learn about new skills and how to perform skills with the outcome of each way described.

There are several advantages of classroom methods. The main one is that it is an efficient way to present a large part of materials. It is a face-to-face method that allows better interaction between the lecturer and the audience. This method also ensures that everyone receives the same portion of information and it is very cost-efficient.

In many cases the success depends on the charisma of the lecturer. Another disadvantage of this method is that it requires scheduling classroom sessions for a large number of trainees that can involve some organisational efforts.

2.2. Computer-based training (CBT)

The **computer-based training methods** are becoming progressively widespread as new technologies are becoming more popular and easier to use. The format varies from the simple text-only programs to a very sophisticated multimedia programs to virtual reality.

- **Text-only programme** is the simplest known computer-based training method. It proposes information on self-placed training in a text-only format. These programmes are considered to be highly effective, because they present complicated concepts in a comprehensible and accessible way.
- **Multimedia.** The training materials can be more sophisticated than the text-based programme. They use audio, video and animation. Multimedia is considered the most stimulating to the adult minds. Notwithstanding their high cost, their benefits may be worth it.
- **Virtual reality** is 3D and interactive, immersing the trainee in a learning experience. They have a form of simulation. They are based on hands-on experience without risks of actual performance. This method is highly beneficial, yet it requires considerable investments in the facilities.

The main advantages of the CBT are that they are computer based and easy to use, can be customized, useful for developing and practicing news skills, they are cost-effective and applicable for self-directed learning.

The disadvantages of the CBT are that they require computer literacy, to have computer access, do not have an interaction with the trainer, poorly designed programme can be boring and it results in poor retention of the gained knowledge.

[1] www.wyzowl.com/employee-training-methods/

2.3. Interactive methods

There are many interactive methods that aim to keep trainees attentive and involved in training.

Quizzes are used to motivate and engage trainees in a learning process. They can be used either at the beginning of the training to find out the knowledge level of trainees, during the training or at the end.

Small group discussion is based on dividing participants into small groups and proposing them a case study for discussion and finding solutions.

Case studies method is used to highlight a specific job-related case through which the trainees can learn how to handle a similar situation in the future.

Active summaries method focusses on recapping the lecture's main points. It is done through creation of small groups. Each group chooses a leader. They prepare a summary of the lecture and the leader presents it to the class.

Q&A sessions is the method used for a small group to update skills rather than to teach new skills.

Question cards is based on a cards system, where the trainees are asked to write their questions on the topic. They are collected and then a review session is conducted.

Role-playing method is used to teach trainees how to handle various situations before they face them while doing their job. Trainees assume the role and act according to the situation that might happen in the workplace.

Participant control is method in which the trainees are asked to review a subjects list created beforehand. They need to select some items about which they want to learn more. The selected topics are covered during the lecture.

Demonstrations method uses other various tools or equipment that show practical/real cases, related to the training topic.

2.4. Experiential methods

Hands-on or experiential method is based on learning from practical training and has several types:

- **Cross-training** method is based on allowing the trainees to try and experience other jobs, which will provide the trainees with new skills and allow them to perform more than one job in the future.
- **Demonstrations** method is based on grabbing the trainees' attention to teach them how to use new equipment or learn the steps in a new process.
- **Coaching / mentoring** method is based on improving performance, by focusing on the individual needs of a trainee.
- **Apprenticeships** method provides an opportunity to a trainee to fit an existing or future job. This method can be combined with supervised training and classroom instruction.
- **Drills** method is used to practice already learned skills.

2.5. Online/e-learning methods

There is other learning method that is more popular and based on an access to the Web. Some of the most popular online training methods are:

Web-based training puts on the Web which can be made available to the trainees. They can contain various courses on different topics. They provide a hands-on, interactive way for trainees to work through various presentations, which are similar to PowerPoint. The materials on the Web are also easy to be updated. Sometimes Web-based trainings are linked with software that make trainee's progress trackable.

Tele- or videoconferences allow passing knowledge from trainer, who is in one location and the trainees in different ones. This method allows active interaction via the telephone or by a web-chat.

Audioconferences are similar to previous one, but they involve audio only.

Webinars include both audio and video elements. A trainee receives live audio training and follows the visual materials that are displayed on the screen.

Online colleges and universities are also known as distance learning options.

Collaborative document preparation requires a trainee to be linked on the same network. It can be used with coaches and trainees to teach writing reports and technical documents.

E-mail is used to enhance training, namely by sending reminders about upcoming trainings, conduct training evaluations through e-mails, etc.

The online training methods present several advantages:

- They are very suitable for training across multiple locations.
- Cost saving.
- Useful for refreshing training as well as self-direction learning.
- Easy to update with new materials.
- They offer a range of choices to match training programme to the knowledge and skills of trainee.

There are also some disadvantages:

- They require PC literacy.
- They are usually generic and not customised for the trainee's needs.
- They are impersonal.
- They require an internet connection.
- They require suitable hardware devices.

2.6. Blended learning approach

Blended learning approach is based on combining several learning methods to train on a specific subject to achieve a greater success. It is used to reduce both the time and cost of training, to improve results in learning outcomes and it resembles the way people learn on the job, through experience and interaction with other people. This method keeps both trainer and trainees engaged in training.

3. C-MobILE learning approach

In the C-MobILE project a combination of several training methods is used. As described in section 2.6, this method is called "blended learning approach." During the training, PowerPoint presentations were combined with short videos and use of multimedia. After each part of training a Q&A session was given which also was combined with several online quizzes to test the level of learned information. Furthermore, during the training some elements of e-learning were used to increase the knowledge of the participants. A key method used was the demonstration method, where the participants had a chance to learn about the new C-ITS services and test the devices in real or simulated conditions.

3.1. Training modules

Each training programme consists of five main modules:

- **Theoretical module**
- **Deployment site C-ITS services**
- **Practical module**
- **Knowledge test**
- **Additional training** (optional)

3.1.1. Theoretical module

This module provides basic understanding of ITS and C-ITS services, communication technologies and benefits of C-ITS. It consists of two parts. The first part aims to give a basic understanding of ITS and C-ITS technologies. The second part focuses on the specific C-ITS services that are relevant for professional drivers and fleet managers. Theoretical module serves as a preparatory step to the next modules which focus on particular C-ITS services as well as on increasing practical experience from working with the services in real time conditions.

3.1.2. Deployment site C-ITS services module

The second module looks at C-ITS services and technologies deployed in a city or region. Here the main emphasis is to present a set of specific services deployed in a specific place. In this module a limited number of services are presented. This allows focusing on some specific C-ITS services more in detail, namely which technologies are employed in them, how they function at theoretical level, the benefits, etc.

3.1.3. Practical module

In this part of the training the new C-ITS services and their functionalities are presented to the participants during an on-road showcase in real traffic conditions, demonstrating various features on mobile apps and on-board devices. The acquired theoretical knowledge from previous two modules is put into practice here.

3.1.4. Knowledge test

The knowledge test and survey on ITS and C-ITS technologies are carried out after the training is completed to see how the training exercises helped the participants to acquire new knowledge on C-ITS technologies, especially those services available at deployment site level.

3.1.5. Additional training

Additional training provided by IRU and Continental addresses the Smart Tachograph, which is mandatory from June 15, 2019 in newly registered commercial passenger transport vehicles >3.5t carrying more than 9 passengers for more than 50km. This technology presents various opportunities and challenges for the industry. This additional, optional training is relevant only for the professional truck, bus and coach drivers and has been presented to attract more interest from this audience. Therefore, it is scheduled only in Bilbao, Vigo and Copenhagen. Since in other DSs the audience was composed of taxi drivers or other type of users, this additional training was not included on the agenda.

3.2. Preparation of training

Preparation of the training in each DS was carried out at several levels:

Content level:

- Identification of C-ITS services to be presented during the training
- Identification of targeted audience (drivers, fleet managers, transport operators, other end-users)
    - Number of participants
    - Language
- Preparation of the training programme and its content:
    - Theoretical part
        - Lecturer(s), guest speaker(s)
    - Practical part
        - Identification of selected C-ITS services to be presented
- Availability of technologies for training (tablets, projectors, smartphones, screens, etc.)
- Availability of training materials (presentations, leaflets, videos)

Date and Venue:

- Identification of partners to support training
- Selection of the date for the training
- Selection of training location (considering closeness to show-case facilities, demo places, etc.)
- Preparation of the training agenda

Communication level:

- Launching the information on C-MobILE website
    - Agendas (English and local language)
    - Registration link
    - Practical information
- Advertising among the project members
- Advertising the training using the social media:
    - LinkedIn
    - Twitter
    - Partners websites, etc.

Follow-up level:

- Preparation of a short report on the training provided

4. Deployment Sites

The training sessions prepared by the C-MobILE project partners gave an opportunity to the participants to learn about several C-ITS services deployed in the eight sites involved in the C-MobILE project. The trainings were planned to be conducted in May-August 2019.

Calendar of training per DSs:

- Barcelona – 7 May
- Thessaloniki – 31 May
- Bilbao – 10 June
- Bordeaux – 14 June
- Newcastle – 14 June
- Vigo – 20 June
- Copenhagen – 27 August
- North Brabant – 10 September.

4.1. Scope and Benefits of C-ITS Training

The trainings focused on several services explained to the participants and experienced during the training sessions:

- Road Works Warning
- Road Hazard Warning
- Emergency Vehicle Warning
- Signal Violation Warning
- Warning System for Pedestrians
- Green Light Optimal Speed Advice
- In-Vehicle Signage
- Emergency Brake Light
- Slow or Stationary Vehicle Warning
- Motorcycle Approaching Indication

The planned trainings gave the opportunity to participants to look at how C-ITS technologies work, their functionalities and how to use them. They could provide their feedback on improvements or additional functionalities.

Each training session was accompanied with videos from real and simulated service tests, showing how C-ITS services can influence the behaviour of all road users, including drivers, cyclists, or pedestrians.

Every participant experienced a combination of C-ITS in real-life traffic conditions and gain a hands-on understanding of how these technologies can improve traffic flow, travel times, fuel efficiency, comfort, and overall safety for them and for other users.

4.2. Agenda of the training

Each training on C-ITS services was scheduled for approximately 5-6 hours. The agenda of each training included 4 modules or 5 (when optional training module was included). Here we present an example of an agenda that includes all 5 modules:

08:30 – 09:(	Registration
09:00 – 09:1	Introduction (DS)
09:15 – 10:0(	Introduction to ITS and C-ITS technologies (IRU Projects)
10:00 – 11:0(	Presentation of C-ITS services deployed (DS)
11:00 – 11:15	Coffee Break
11:15 – 12:00	Testing of C-ITS services deployed (DS)
12:00 – 12:3(	Additional module (e.g. smart tachograph)

12:30 – 13:0(	KNOWLEDGE TEST & SURVEY (IRU PROJECTS)
13:00 – 14:0(	LUNCH BREAK / PREPARATION FOR TESTING C-ITS SERVICE
14:00 – 15:3(	TESTING OF C-ITS SERVICES DEPLOYED (DS)
15:30	END OF TRAINING PROGRAMME

5. Training materials

5.1. Theoretical module

The content of the theoretical module of each training programme consisted of two parts, namely introduction to ITS and C-ITS technologies and ITS and C-ITS services for professional users. The information for each part of this module was taken from the online e-learning platform of the CAPITAL project and it was based on two videos (Lecture 1 ITS 1 and Lecture 1 ITS2)[2]. Each video was followed by a short online quiz based on the CAPITAL project.

The theoretical part covered several topics related to C-ITS technologies. The selection of topics depended on several factors, namely the participants/audience (i.e. drivers, public authorities, etc.), their knowledge level regarding C-ITS as well as deployed services in the deployment site. However, some topics of the theoretical part were included for each category of participants. Each part lasted approximately 30 minutes.

1. Introduction to ITS and C-ITS technologies
    a. Explanation of Intelligent Transport Systems
        i. Definition
        ii. Application
    b. Cooperative Intelligent Transport Systems
        i. Definition of C-ITS
        ii. Communications
        iii. Evolution of C-ITS
        iv. Benefits
        v. Services
        vi. Service Bundling
2. ITS and C-ITS services for professional users
    a. ITS and C-ITS services for professional drivers
        i. ITS services
            1. Speed alert system
            2. Dynamic navigation systems
            3. Eco-driving assistance
            4. Adaptable headlights
            5. Blind spot information system
            6. Lane departure warning
            7. Obstacle and collision warning
            8. Emergency braking
        ii. C-ITS services for professional drivers
            1. Urban parking availability
            2. Signal violation warning
            3. Warning system for pedestrian
            4. Green priority
            5. Green Light Optimal Speed Advisory (GLOSA)
            6. In-vehicle signage (IVS)
            7. Emergency Brake Light
            8. Cooperative Adaptive Cruise Control
            9. Motorcycle approach indication
            10. Blind spot detection / warning (VRUs)
            11. Non-stop truck

5.1.1. Introduction to ITS and C-ITS technologies

This section presents the materials (PowerPoint presentations) that were used in the first part of the theoretical module on Introduction to ITS and C-ITS technologies. Each slide of this presentation is followed by a short explanation of the slide.

Introduction to ITS and C-ITS: What are Intelligent Transport Systems?

Intelligent Transport Systems is abbreviated to ITS. There are many definitions of what ITS are. However, in general, ITS are the application of computer, communications and other information technologies to transport, to improve efficiency, robustness and safety through new infrastructure-based, in-vehicle, and public transport systems. ITS make use of technologies like wireless, mobile, satellite, and information communications technology. Examples of ITS are varied, including things like congestion charging technology, smart cards, and traffic management. In the study topic that accompanies this module you will be able to find some other definitions of ITS. It should be emphasized that ITS supplies a comprehensive set of tools that can be used in different combinations to address specific policies and to provide powerful solutions to real problems.

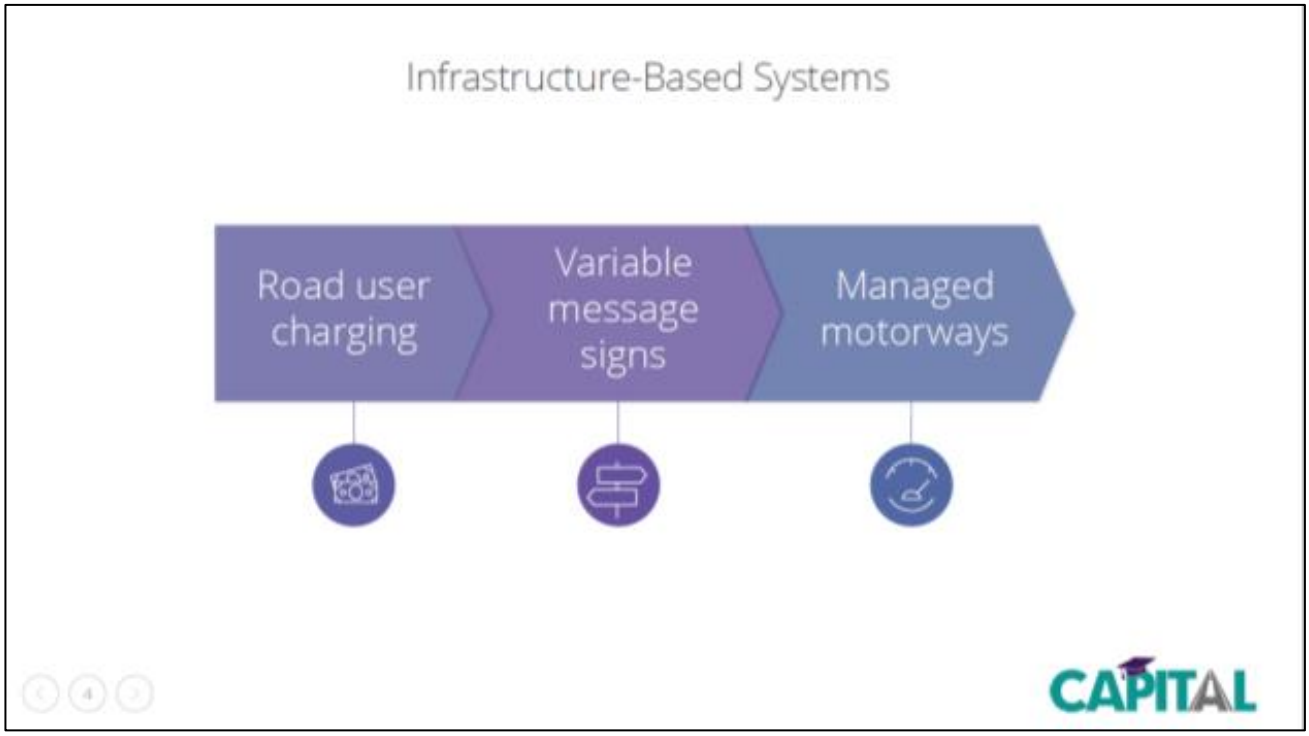


Figure 1: Infrastructure based ITS systems

For this introductory course, we have categorized ITS systems and services into infrastructure-based services, vehicle-based services and public transport services. Infrastructure based systems use short range and long-range communication technologies as well as conventional communication technologies, to contribute to the high-level goal of sustainability and accessibility, through the provision of the right information, at the right time and in the right place. Examples of infrastructure based ITS systems include road user charging, variable message signs and managed motorways.

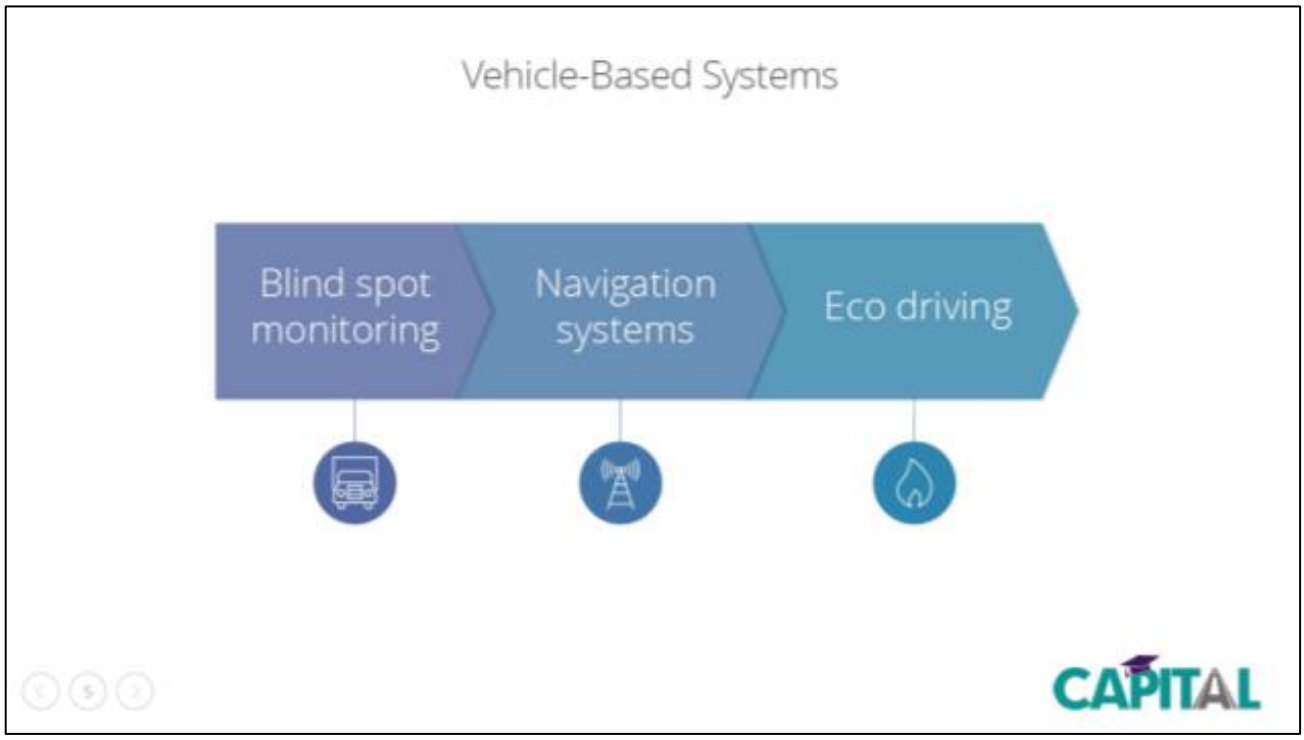


Figure 2: The second categorization is vehicle-based systems

Vehicle-based systems use telematics and in-vehicle technologies to contribute to high level goals of safety and sustainability. Examples of vehicle-based systems are blind spot monitoring, navigation systems and eco driving.

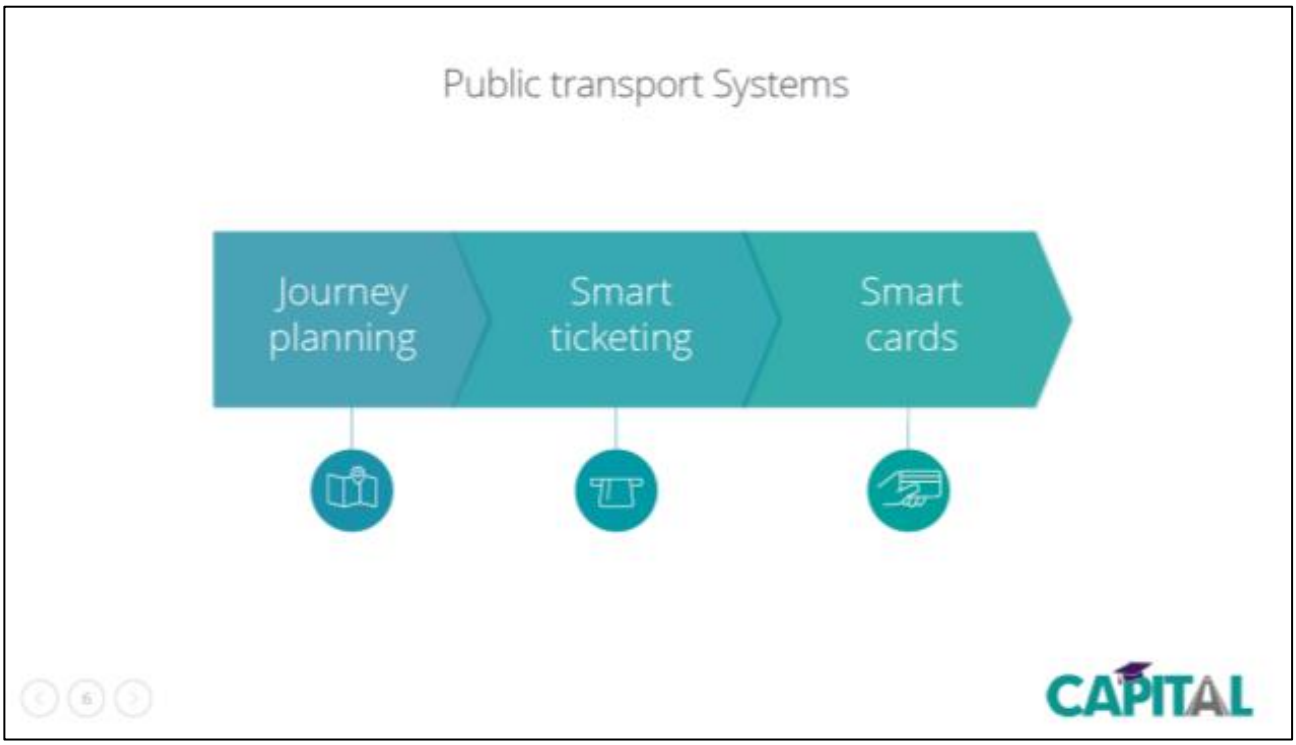


Figure 3: Public transport ITS systems

The third category of ITS system is ITS for public transport. These types of systems use GSM communication technologies to contribute towards the overall goal of increased information and connectivity. Examples of ITS for public transport include journey planning,

smart ticketing and smart cards. ITS is an important component of Smart cities, Mobility as a Service (MaaS), Connected and Autonomous vehicles and Integrated Transport Systems.

ITS also underpins a number of innovative concepts such as Connected and Automated Vehicles, Smart Cities, Mobility as a Service and Integrated Transport.

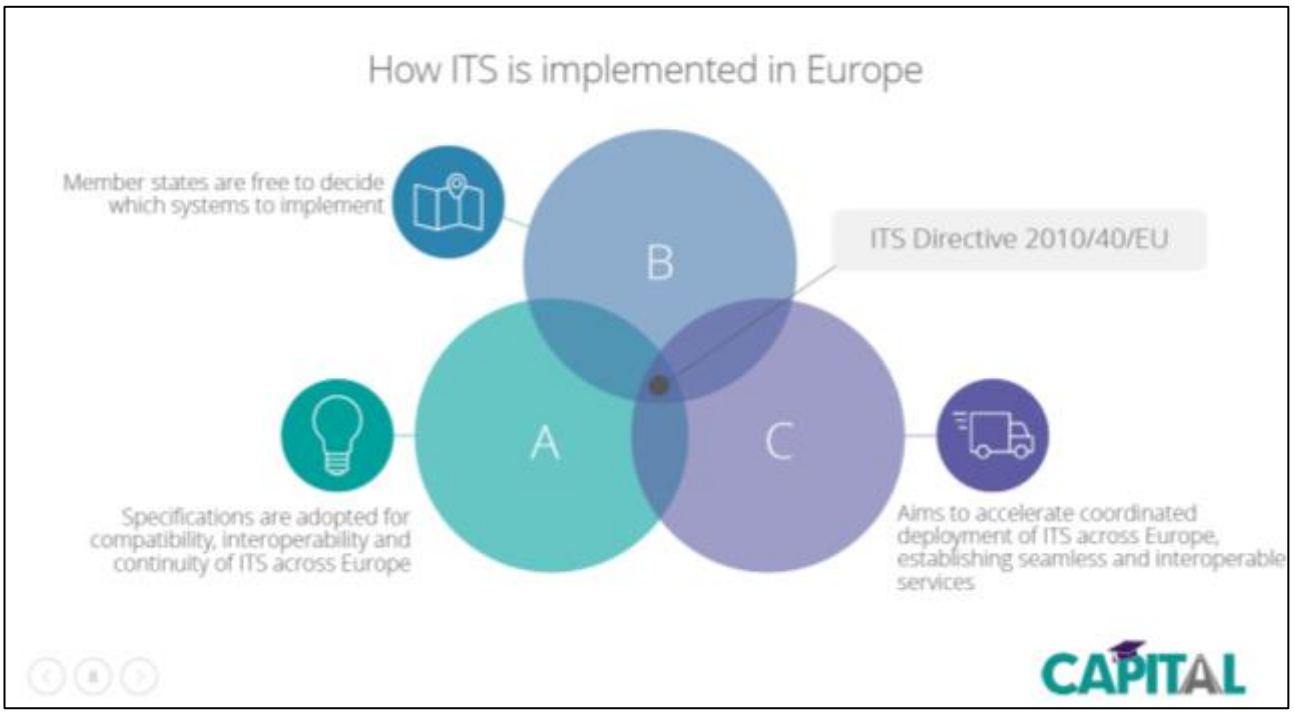


Figure 4: How ITS are implemented in Europe

ITS deployment has increased dramatically since the 2010 ITS Directive. This aimed to accelerate coordinated deployment of ITS across Europe, establishing seamless and interoperable services. Member states are free to decide which systems to implement. Specifications are adopted for compatibility, interoperability and continuity of ITS across Europe. The first services covered by the Directive were: Traffic and travel information; Emergency call (known as e-Call), and Emergency truck parking.

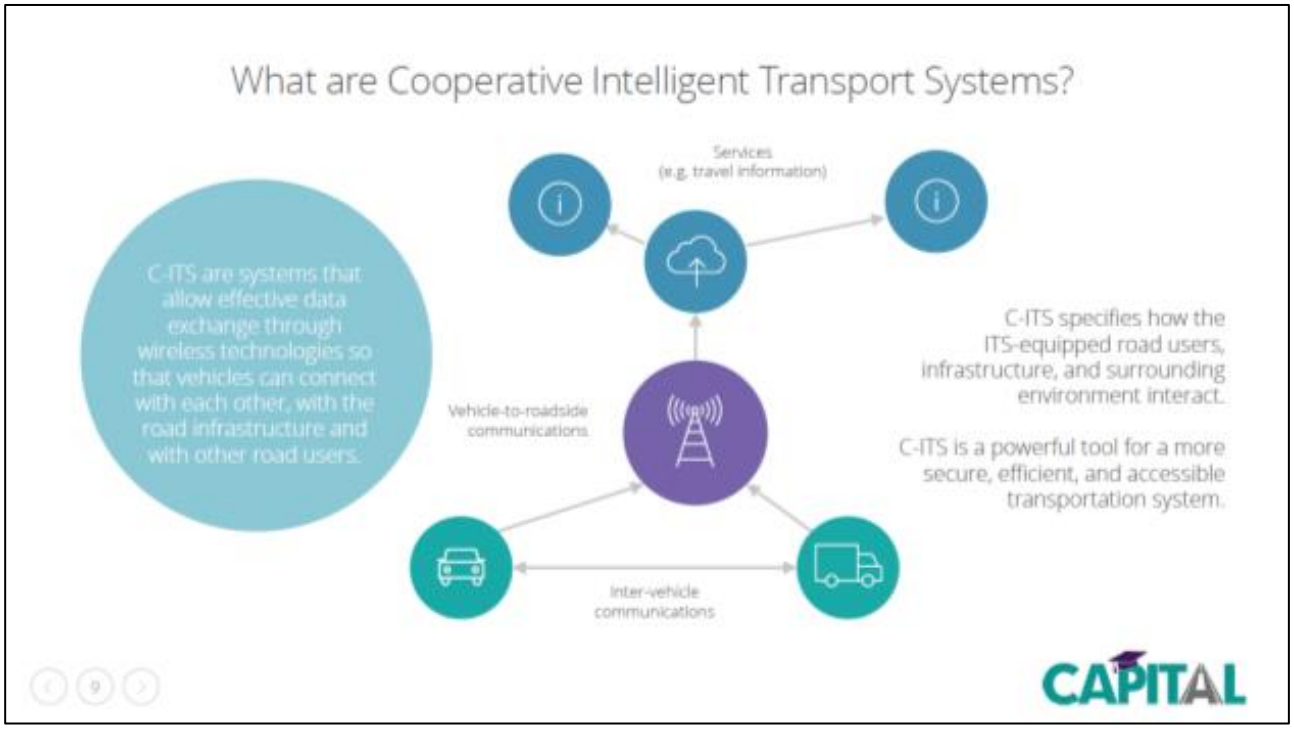


Figure 5: What are Cooperative ITS

Cooperative ITS is abbreviated to C-ITS. Again, there are many definitions for C-ITS. In general, they are technologies that provide real time communication between vehicles, infrastructure and other road users. C-ITS technologies and applications allow effective data exchange through wireless technologies between different elements and actors of the transport system. This means that road users and traffic managers can share information and use it to coordinate their actions.

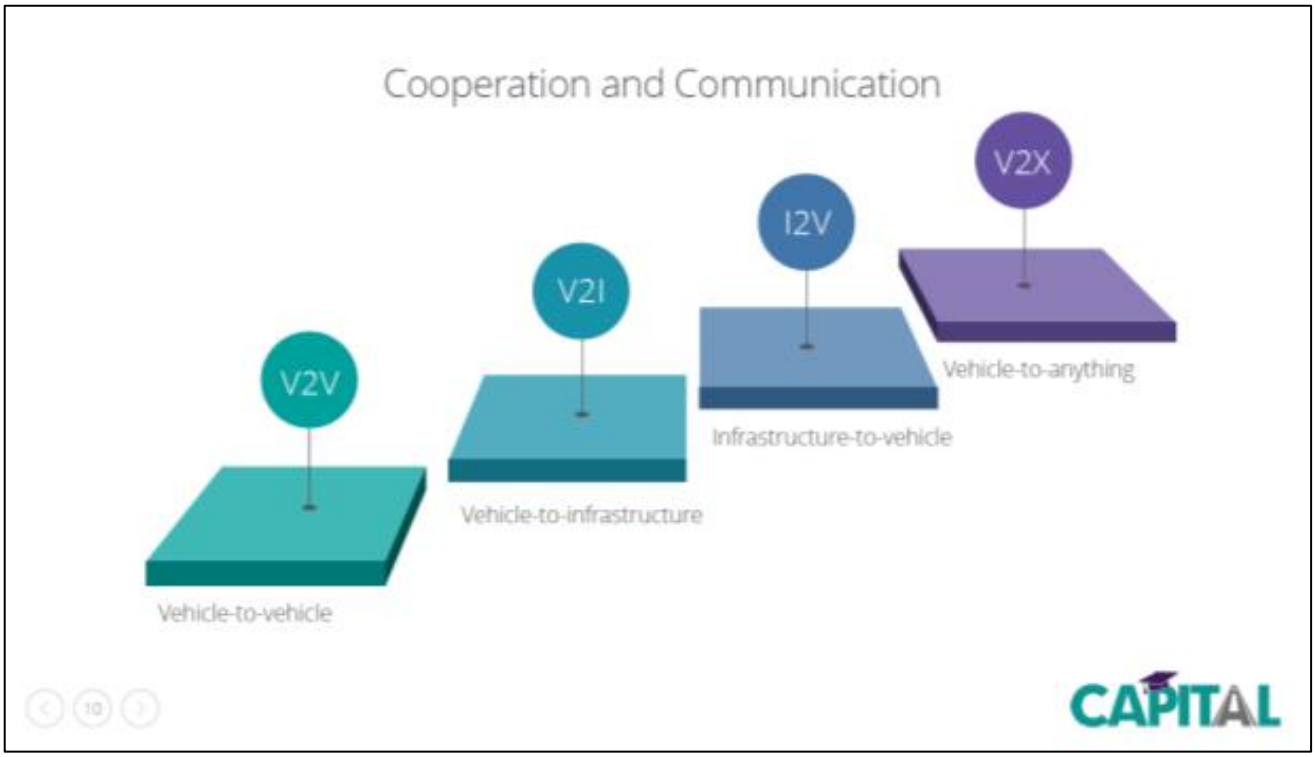


Figure 6: Cooperation and Communication

One of the ways that C-ITS is different from ITS is that CITS includes different types of digital connectivity – or cooperation – between vehicles and infrastructure.

There are four main types of digital cooperation:

- Vehicle to vehicle (or V2V)
- Vehicle to infrastructure (or V2I)
- Infrastructure to vehicle (or I2V), and
- Vehicle to anything or (V2X)

Based on these CITS technologies and the ability of vehicles to connect and communicate with each other, a new concept, “the Connected Vehicle”, has arisen - this includes vehicles which are able to communicate not only with each other but with the world around them.

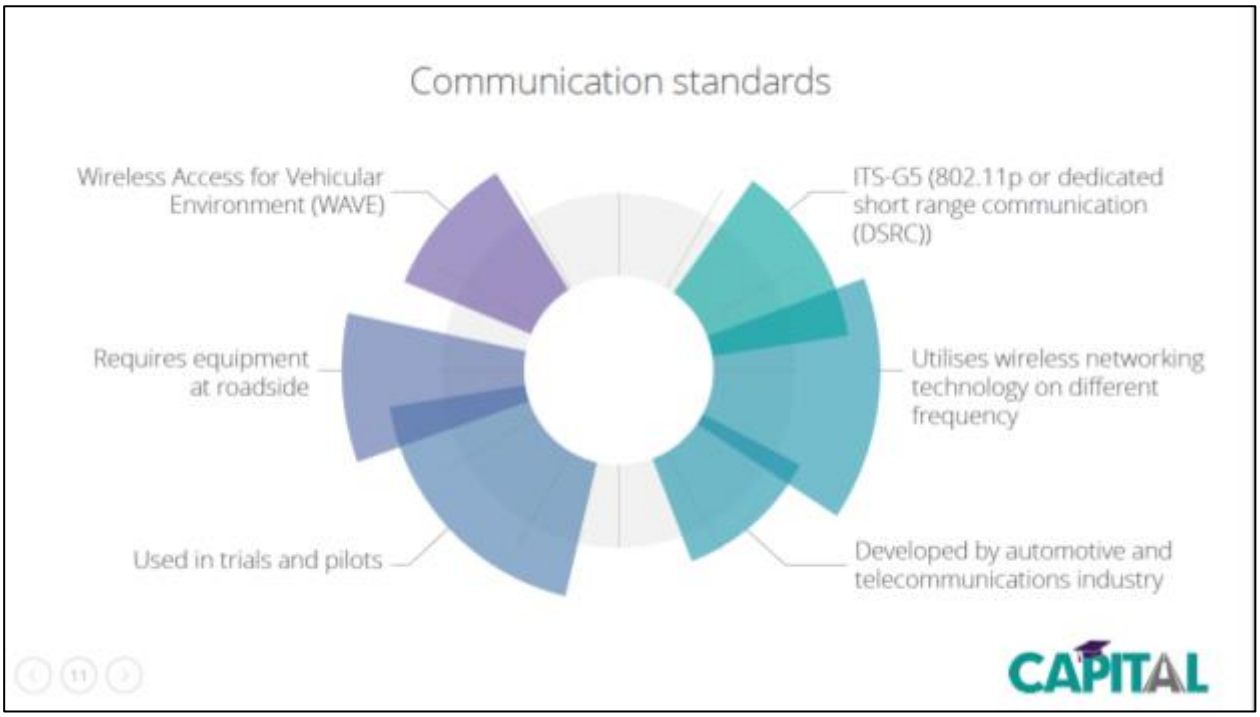


Figure 7: Communication Standards

In Europe, the communications technology for CITS is known as ITS-G5 (sometimes known as 802.11p or dedicated short range communication (DSRC)). DSRC are a special form of wireless networking technology on a different frequency from other wifi; it has been developed by the automotive and telecoms industry and has been used in trials and pilots. The technology behind the short range communication standards is WAVE, which stands for Wireless Access for Vehicular Environment.

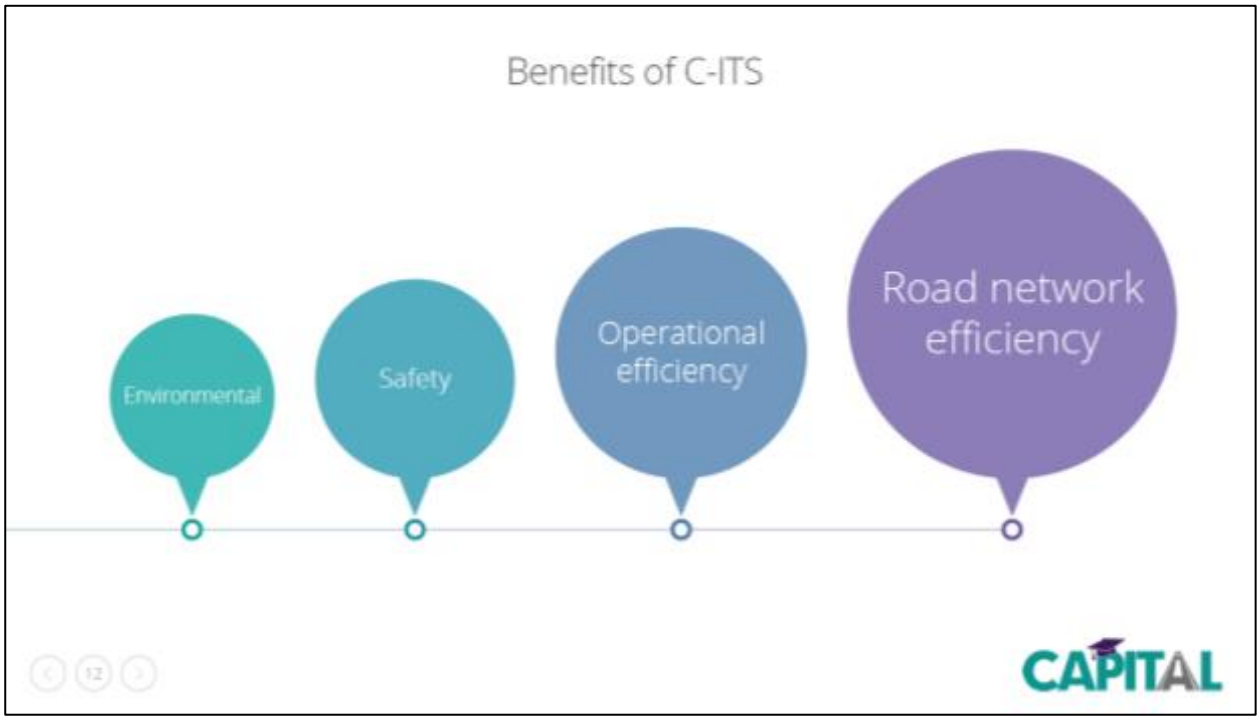


Figure 8: Benefits of C-ITS

C-ITS offers a wide range of services with diverse benefits. These include:

- Road network efficiency
- Operational efficiency (for example, for freight or public transport)
- Road safety for all users

- Environmental improvements (especially in urban areas)

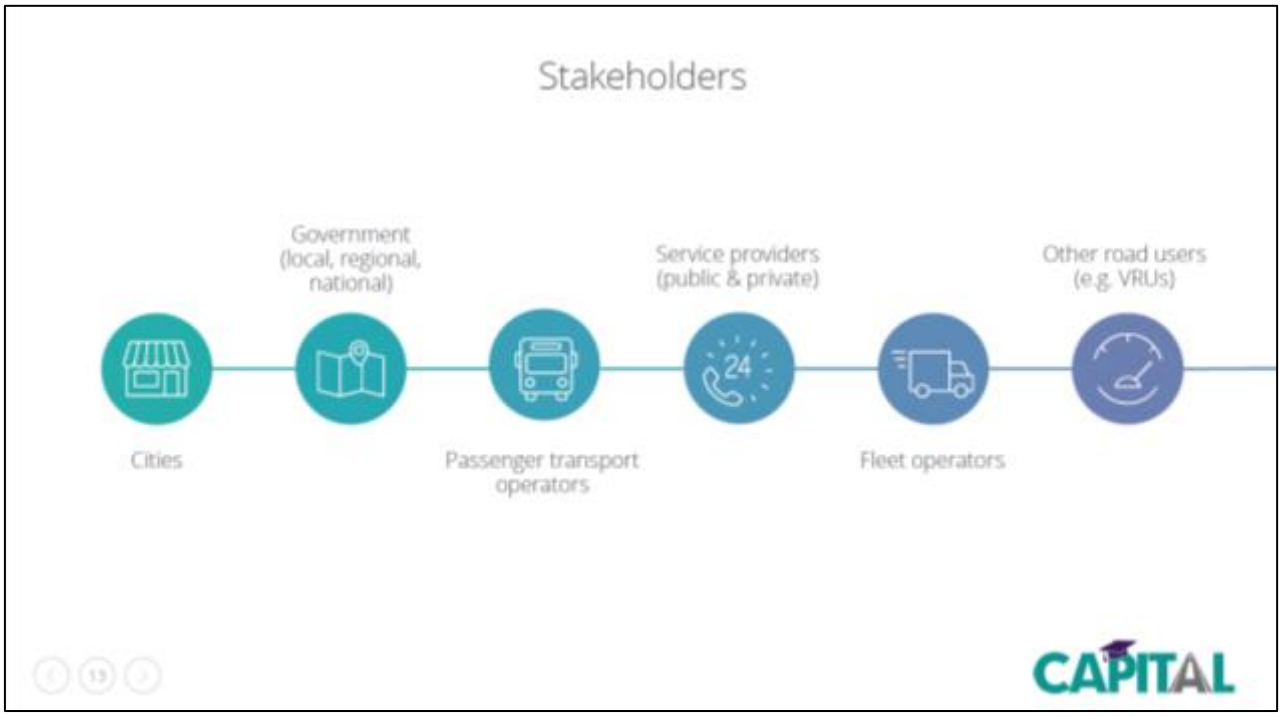


Figure 9: Stakeholders

Because the services that C-ITS can provide - improving efficiency, safety and the environment - are very much policy- and user-driven, C-ITS can clearly contribute to the challenges that face cities, road authorities, and operators today. C-ITS deployment is thus user-driven or policy-driven. Stakeholder beneficiaries include:

- Cities (policy makers and engineers)
- Government (local, regional, national)
- Passenger transport operators
- Service providers (public and private)
- Fleet operators
- Other road users (e.g. Vulnerable Road Users)

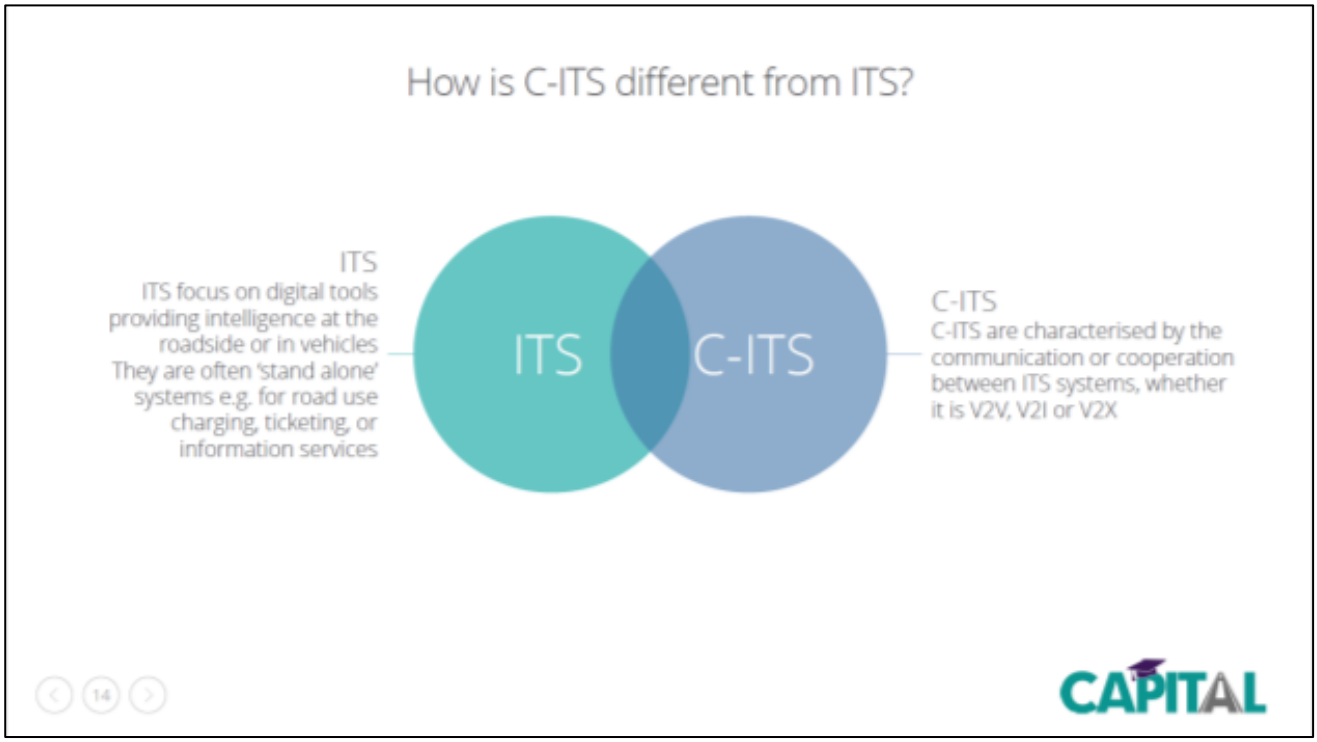


Figure 10: How is C-ITS different from ITS

It can be difficult at first glance to appreciate any difference between C-ITS and ITS. ITS are a set of digital tools providing intelligence at the roadside or in vehicles. They can often be 'standalone' systems e.g. for road use charging, ticketing, or traveller information.

C-ITS are characterized by the communication – or cooperation - between ITS systems, whether it is V2V, V2I or V2X. Sometimes C-ITS is seen as a type of ITS, or at least a process enabling ITS to deliver specific services. In general, C-ITS builds on an already powerful set of ITS tools, providing the opportunity to deploy more integrated, joined up, systems, supporting different transport-related functions, providing a more holistic approach to delivering user- or policy-driven services.

5.1.2. ITS and C-ITS services for professional users

In this section the material (power point presentation) that was used in the first part of the theoretical module on 2. ITS and C-ITS services for professional users is presented. Each slide of this presentation is followed by the short description that explain the content of the slide.

Here we focus on ITS and C-ITS services particularly designed for professional drivers. Here we will also try to define who the 'professional drivers.' are Then we will see what the main benefits of and for professional drivers ITS C-ITS services are.

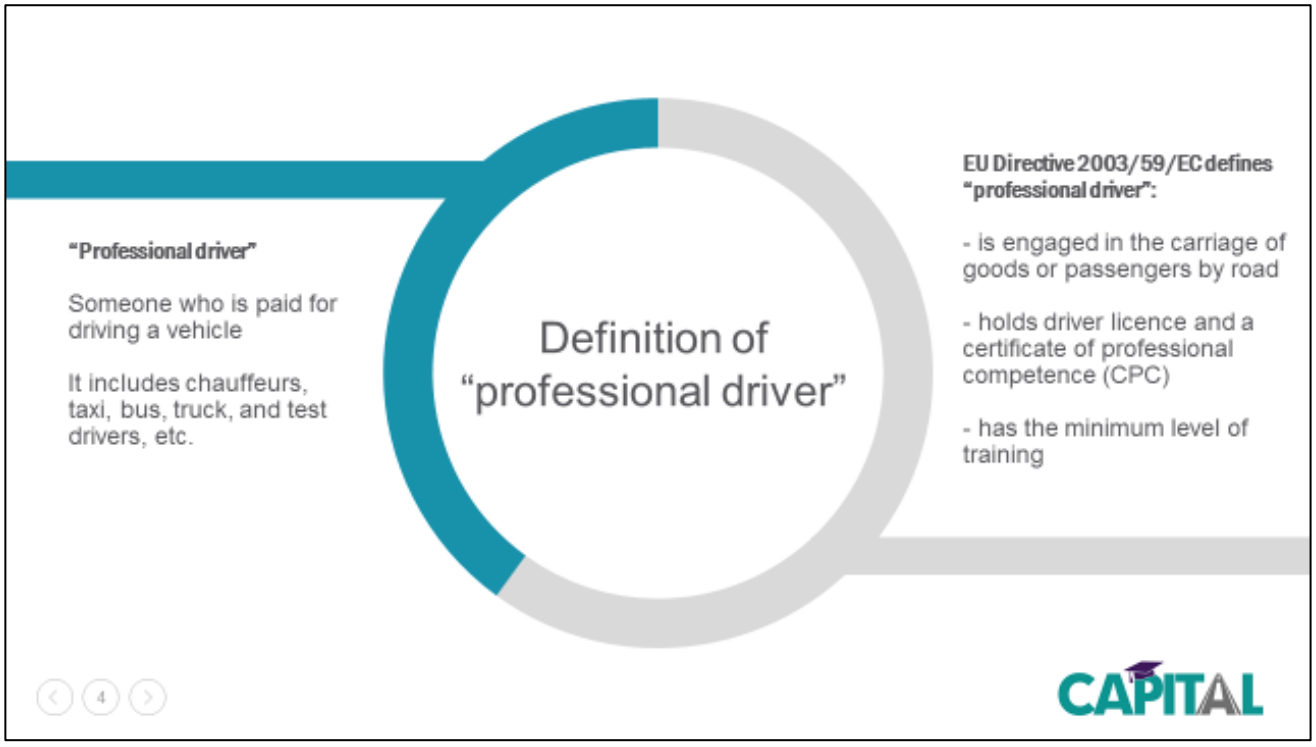


Figure 11: Definition of "professional driver"

To start our presentation, first of all, we need to define who the professional drivers are. However, there is not a clear definition that can define both professional and non-professional drivers. A very simple explanation of a 'professional driver' is someone who is paid for driving a vehicle. It includes chauffeurs, taxi, bus, truck, and test drivers, etc.

The EU Directive 2003/59/EC of the European Parliament and the Council says that "certain drivers engaged in the carriage of goods or passengers by road must, depending on their age, on the category of vehicle used and on the distance to be travelled, hold a certificate of professional competence in conformity with Community rules on the minimum level of training for some road transport drivers. That minimum level is determined by Directive 76/914/EEC."

A professional driver needs to have a Certificate of Professional Competence (CPC) and a valid driving license for the category of driven vehicle.

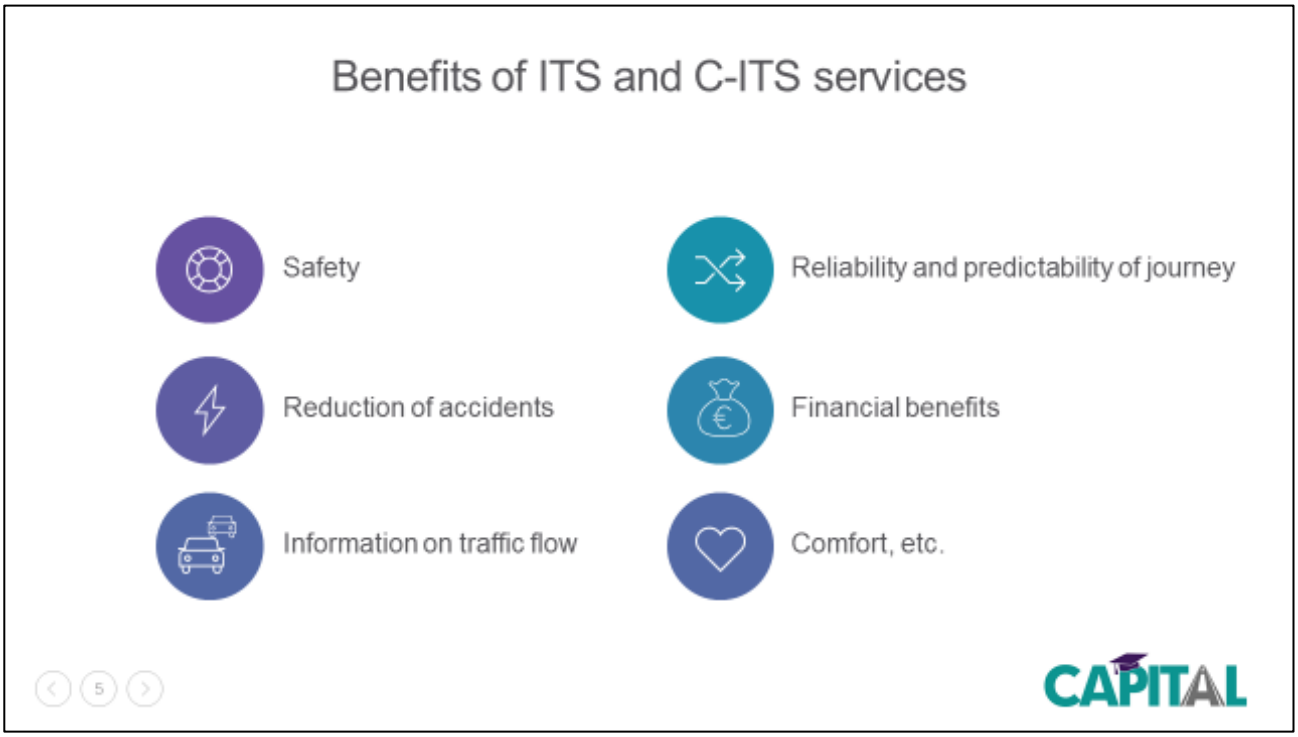


Figure 12: Benefits of ITS and C-ITS services

Having defined who are the professional drivers, let's have a look at ITS and C-ITS services. Before doing it, we need to identify the main benefits of the services.

There are numerous benefits related to ITS and C-ITS services for the professional drivers, but the most important of them are

- safety of drivers and carried freight,
- reduction of accidents on road,
- access to the information regarding traffic flow,
- reliability and predictability of planned journey,
- direct and indirect financial benefits, such us fuel saving, reduction of time in finding parking place, etc. and finally,
- comfort of drivers

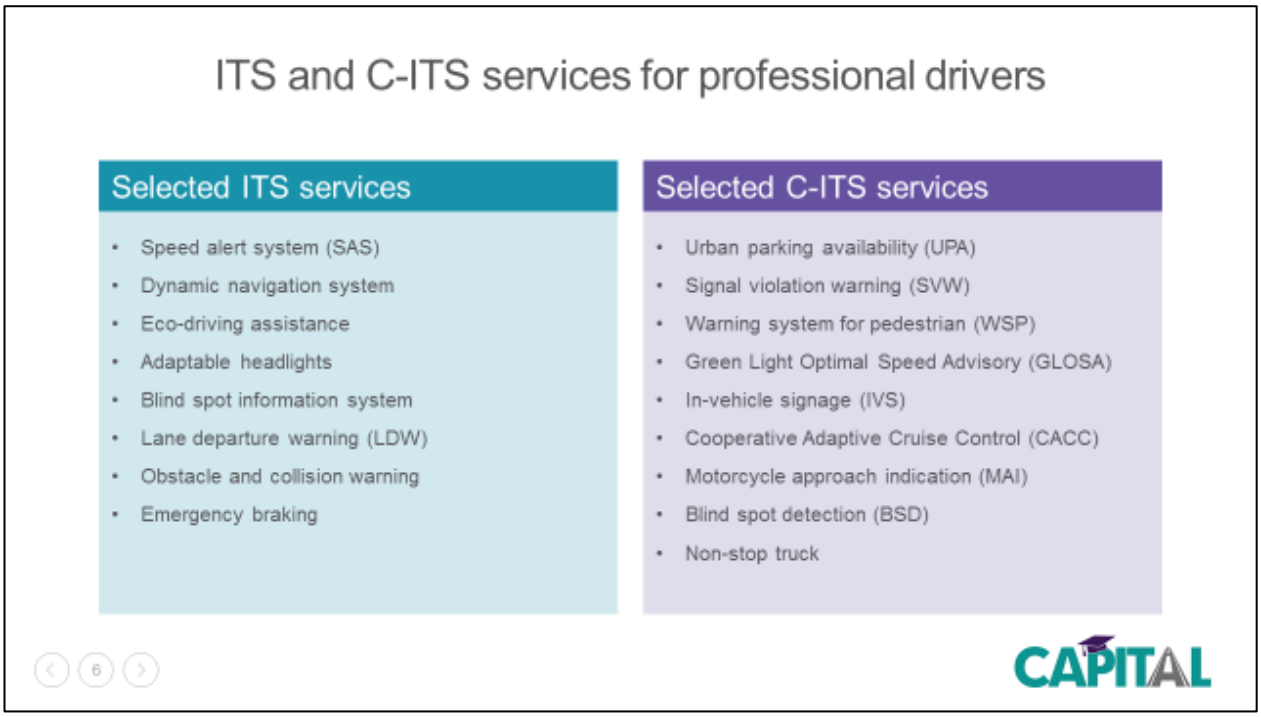


Figure 13: Which are the ITS and C-ITS services designed for professional drivers?

There is a large and growing number of ITS and C-ITS services that support professional drivers; there are some well-established examples in the slide

ITS services:

- Speed alert system (SAS)
- Dynamic navigation system
- Eco-driving assistance
- Adaptable headlights
- Blind spot information system
- Lane departure warning
- Obstacle and collision warning
- Emergency braking

C-ITS services:

- Urban parking availability
- Signal violation warning
- Warning system for pedestrian
- Green priority
- Green Light Optimal Speed Advisory (GLOSA)
- In-vehicle signage (IVS)
- Cooperative Adaptive Cruise Control (CACC)
- Motorcycle approach indication
- Blind spot detection (BSD)
- Non-stop truck

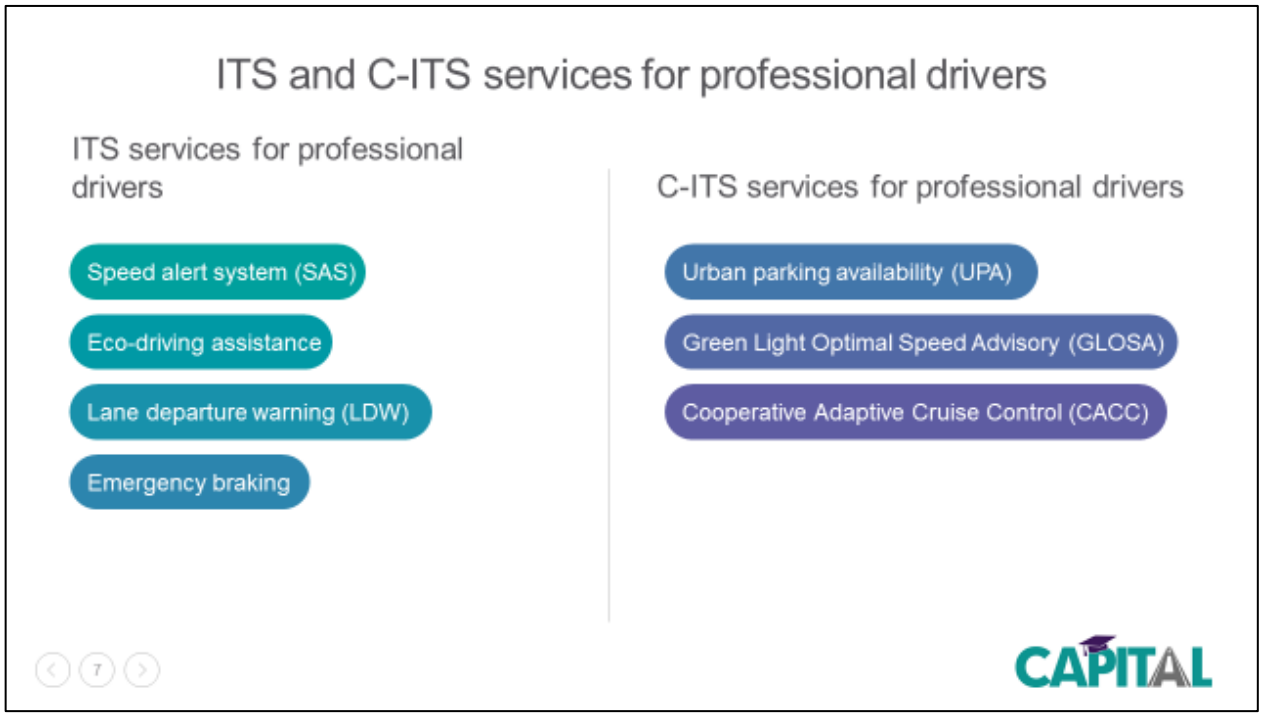


Figure 14: ITS and C-ITS services for professional drivers

Today we will focus on some selected services, namely:

- ITS services for professional drivers
  - Speed alert system (SAS)
  - Eco-driving assistance
  - Lane departure warning (LDW)
  - Emergency braking
- C-ITS services for professional drivers
  - Urban parking availability (UPA)
  - Green Light Optimal Speed Advisory (GLOSA)
  - Cooperative Adaptive Cruise Control (CACC)

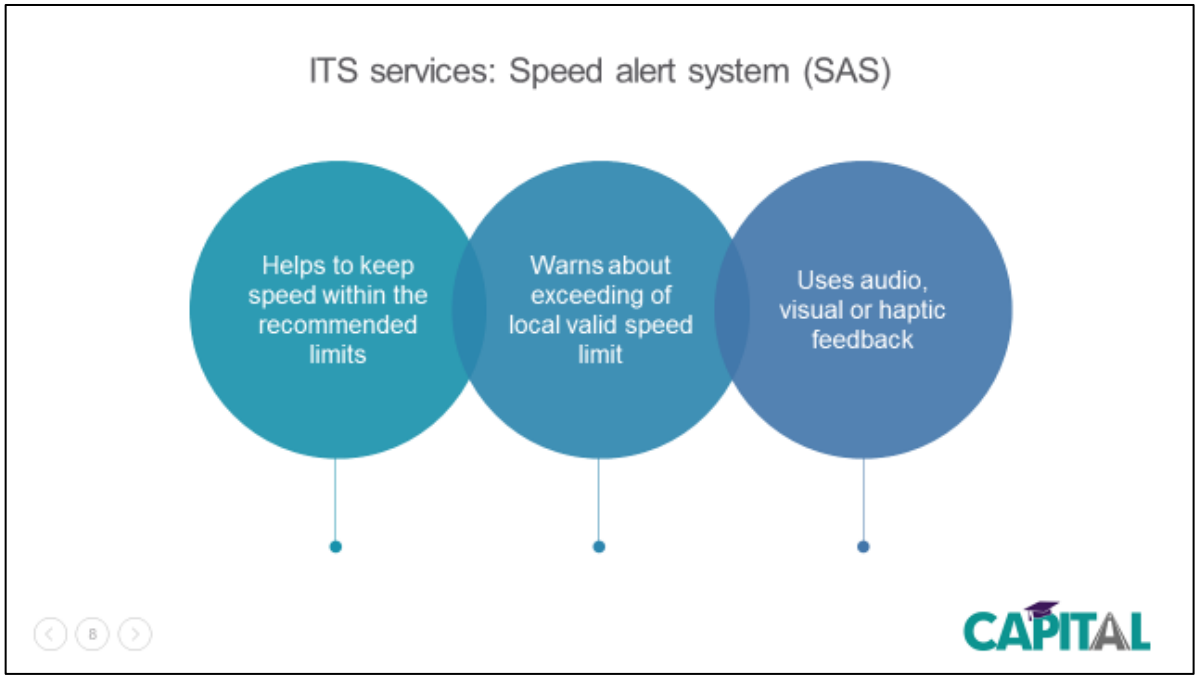


Figure 15: Speed alert system, also abbreviated as SAS

Speed alert system helps a driver to keep their speeds within the recommended limits and warns a driver when the local valid speed limit is exceeded. The system uses audio, visual or haptic feedback.

How does this service work? The information regarding speed limit is received from transponders in speed limit signs or from a digital road map that reads positioning information, or is determined by software which analyses images from a camera and recognises traffic signs. This information is displayed to the driver as a warning message.

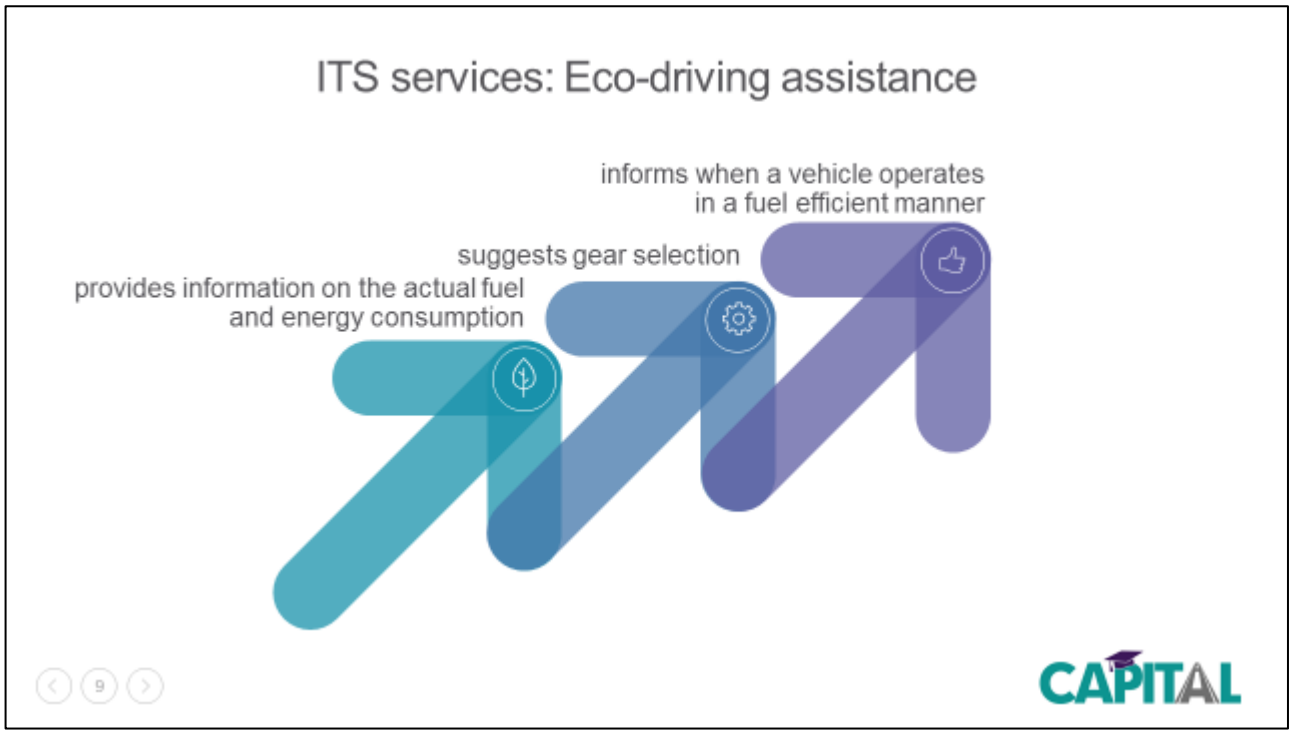


Figure 16: Eco-driving assistance

This slide explains eco-driving assistance service. Eco-driving assistance provides information to a driver regarding the actual fuel and energy consumption in a vehicle. It also suggests gear selection, taking into account engine and transmission efficiency, vehicle speed, rate of acceleration etc. The information on instantaneous fuel consumption is displayed on the instrument panel

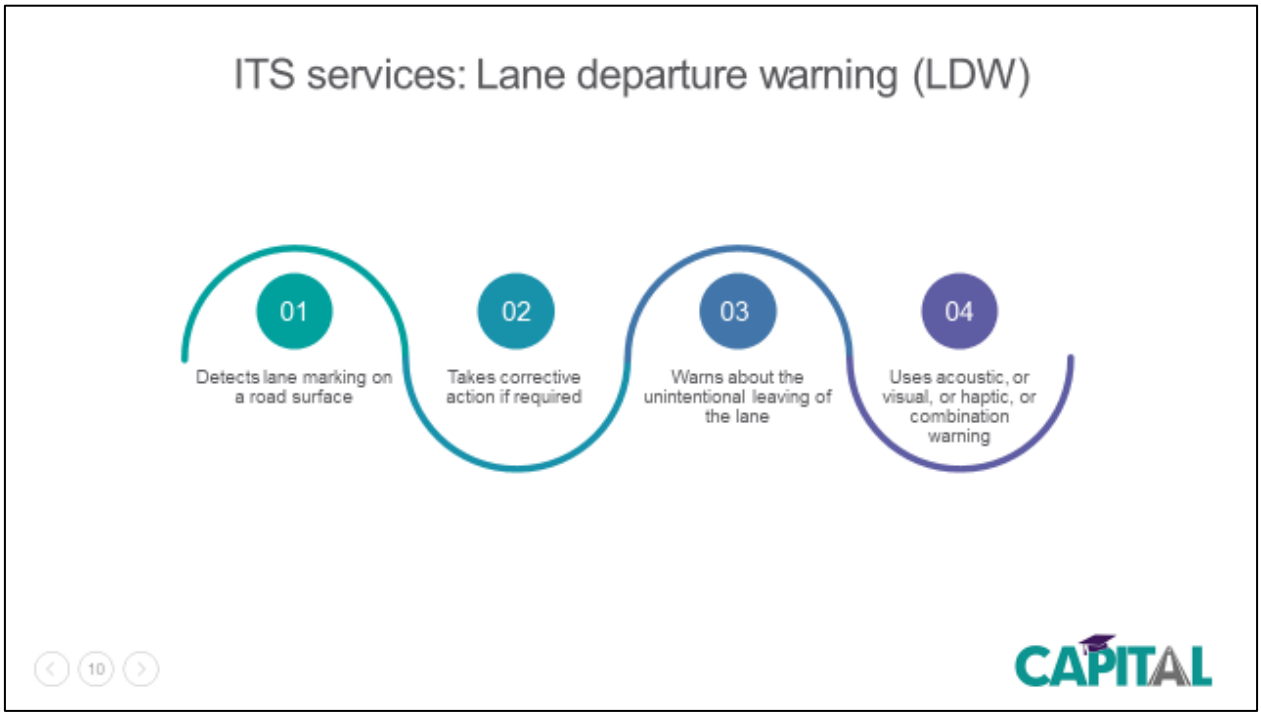


Figure 17: Lane departure warning (LDW)

Lane departure warning (LDW) system was designed to warn a driver about the unintentional leaving of the lane and take corrective action if required. The most used technology is video image processing that detects lane marking on a road surface.

The warning provided by the system can be either acoustic, or visual, or haptic, or combination of several types of warning. How the system works? The forward viewing camera located on a vehicle sends the image of marking on the road to a central computer. By identifying reflective lane markings, an indication of vehicle lane position is established. The information from the steering wheel angle is combined with information received from a camera. The system determines whether the driver is unintentionally leaving the intended driving path. Then a warning is issued. The system can also attempt to correct the situation by nudging the steering wheel in a direction to maintain lane position.

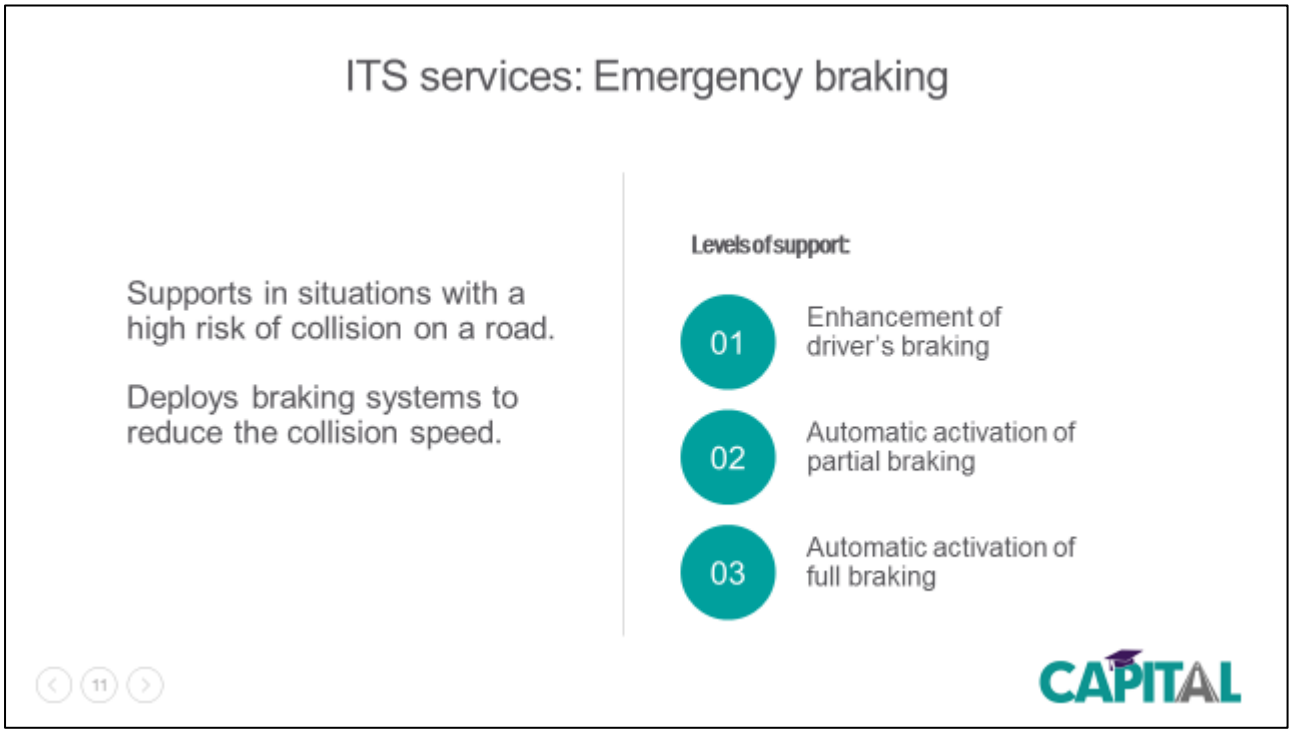


Figure 18: Emergency braking

The final ITS service that is considered in this presentation is emergency braking.

The system is designed to provide support in situations with a high risk of collision on a road by deploying the braking systems of a vehicle to reduce the collision speed and the total crash energy.

There are various levels of support available, namely

- enhancement of driver's braking if necessary,
- automatic activation of partial braking, and
- automatic activation of full braking.

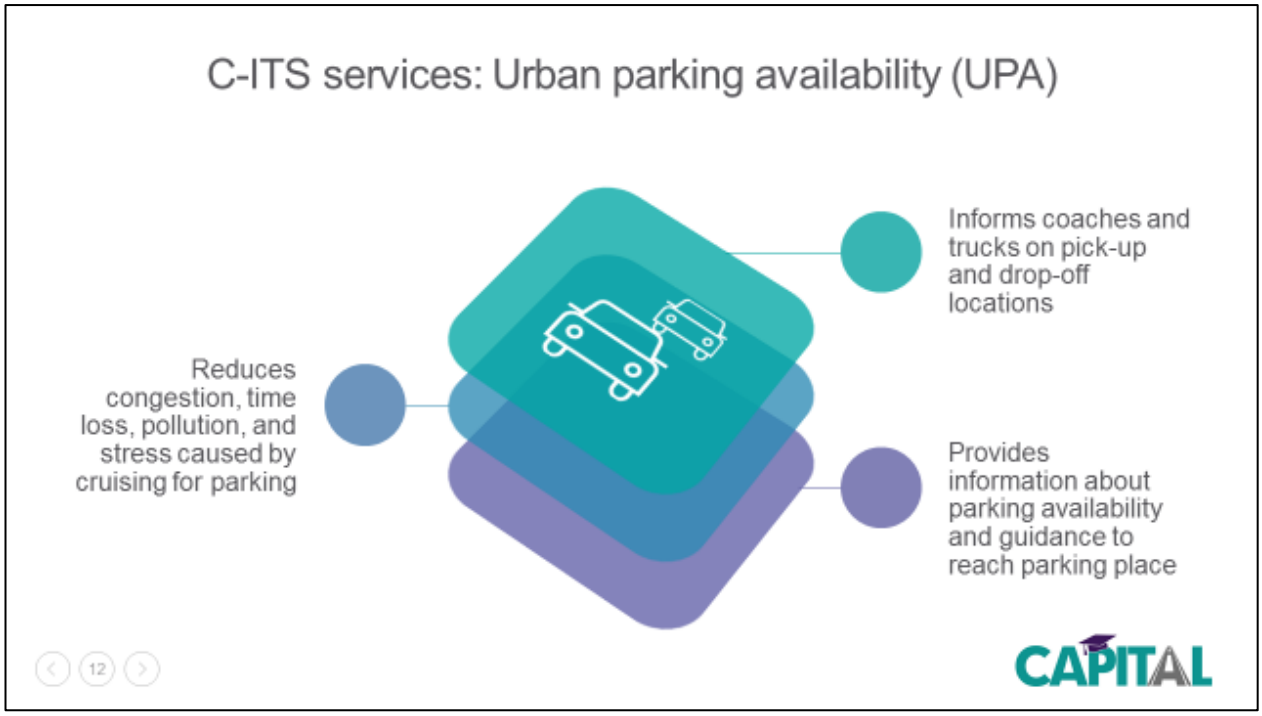


Figure 19: Urban parking availability

The first C-ITS service that we will discuss in this lecture is Urban Parking Availability (UPA).

It provides information about parking availability and guidance for drivers to make informed choices about available parking places. This service aims at a reduction of congestion, time loss, pollution, and stress caused by cruising for parking. It can be used by truck and coach drivers as well as any vehicle driver. It provides information on the availability of parking places and it indicates dimension and weight restrictions, which is valuable information for truck and coach drivers. This service gives information about pick-up and drop-off places where coaches and trucks can stop for a limited time.

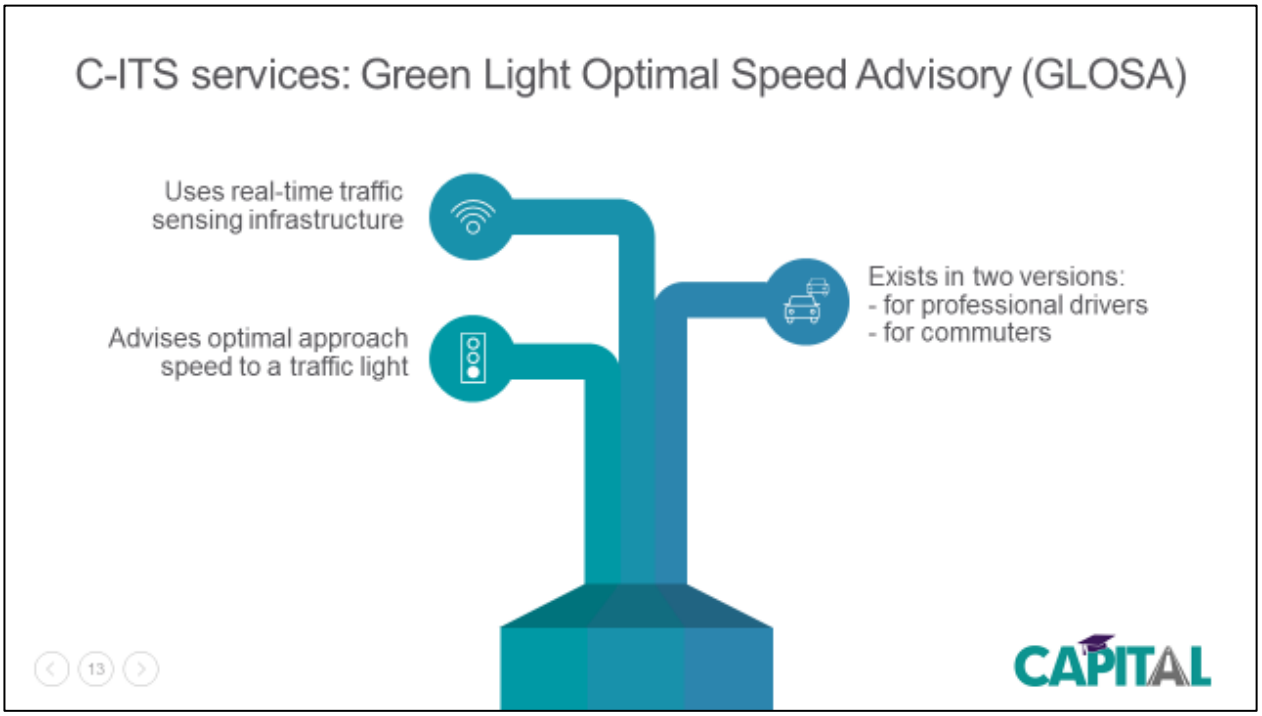


Figure 20: GLOSA

The Green Light Optimal Speed Advisory, also known as GLOSA, gives advice to drivers allowing them to optimise their approach to a traffic light (maintain actual speed, slow down or adapt a specific speed, time to green light).

GLOSA uses real-time traffic sensing and infrastructure information, which is communicated to a vehicle.

There are several benefits from GLOSA service, namely expected

- smoother vehicle trajectory while passing a signalised intersection,
- reduction of stops,
- lower CO2 emissions as well as fuel consumption
- enhanced traffic flow and
- driver comfort.

The service is available in two versions, namely

- for professional drivers (public transport, that make use of the maximum performance) and
- for commuters, who will use the light version (no sensor interfacing).

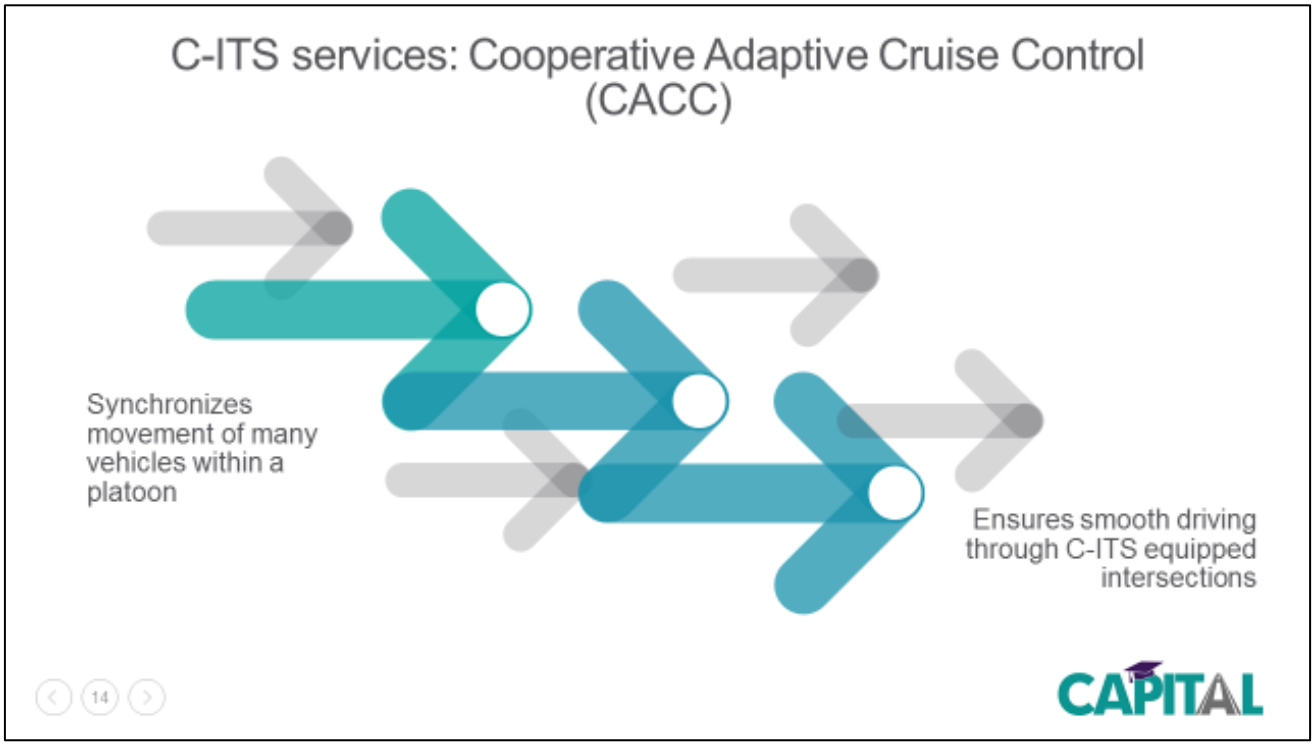


Figure 21: CACC

Cooperative Adaptive Cruise Control (CACC) service uses V2V communications to automatically synchronize the motion of many vehicles within a platoon. It intends to ensure smooth driving of vehicles with CACC function or platooning technologies for driving through C-ITS equipped intersections. Vehicles with this technology benefit from V2V information exchange to improve the efficiency of driving and traffic flow. Currently, the service is under development by the C-MobILE project. Two pilot sites were selected, namely Bordeaux and North Brabant.

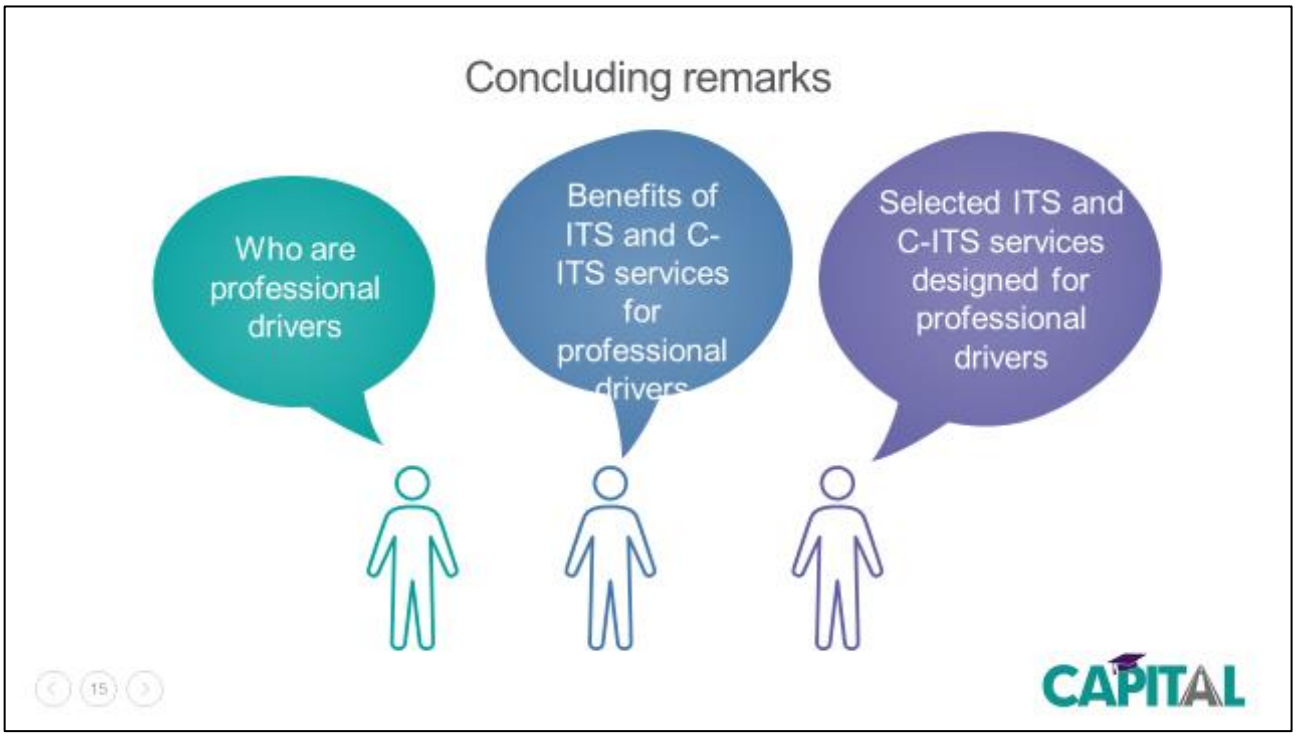


Figure 22: Concluding remarks

This brings us to the end of this lecture. In summary, the main points presented today were:

- We defined today who are the professional drivers
- We briefly presented the benefits of ITS and C-ITS services for professional drivers
- Finally, we briefly focused on the ITS and C-ITS services designed for professional drivers.

Thank you for your attention. For more information on the topic of this lecture, please check related reading and video materials. In the next lecture you will learn about ITS and C-ITS cooperation among professional drivers and public authorities.

5.2. The knowledge test

The knowledge test module is closely connected to the Theoretical module and it is conducted after the theoretical part is completed. Since the knowledge test module is the same in its structure for each DS and do not differ in content for each training, it is presented only once in this document. It was translated into local languages of the DSs (Danish, French, Greek, and Spanish) in order to make it easy for participants to answer the questions.

5.2.1. Used tool for the knowledge test

To test the acquired knowledge by the participants after the Theoretical module, two sets of questions are used, which were prepared by the CAPITAL project. The first test/quiz asks the questions related to the first video (Lecture 1 of ITS 1) and the second one test/quiz is based on the content of the second video (Lecture 1 of ITS 2). Both videos are taken from the CAPITAL Online Training Courses.

Kahoot is a tool that is used by the organiser of each training to test the knowledge of the participants. This tool was chosen for it is simplicity in use and allows identification of the winner of the test who answered all questions correctly and quickly. This tool requires only an Internet connection and a smartphone to take part in the quiz.

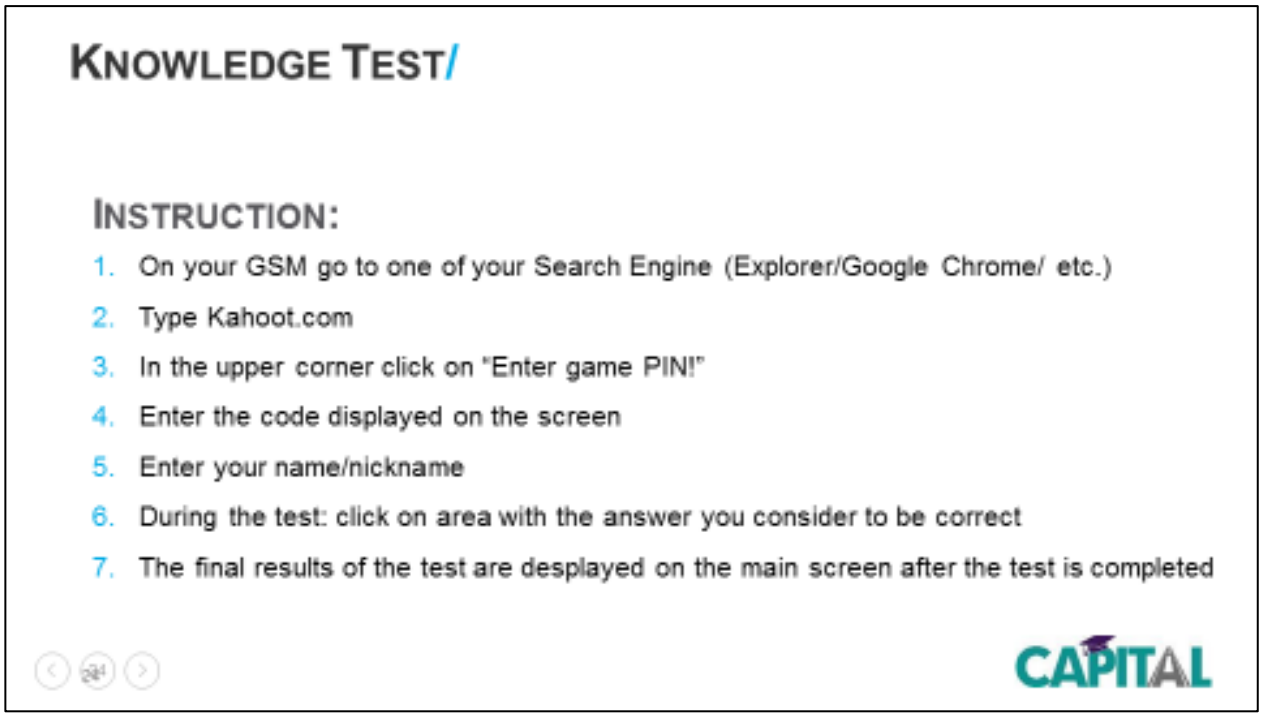


Figure 23: Knowledge test

Before each test/quiz the organiser shows a slide with instructions how to participate in a quiz.

5.2.2. Questions for the Knowledge test

5.2.2.1. Test 1: What are ITS and C-ITS?

1. ITS is a short name for?
a) Information Transfer Systems
b) Intelligent Transport Systems
c) Intelligent Transport Services
d) Information Transport Services

2. Which of the following are technologies used by ITS?
a) Wireless
b) Satellite
c) Both a and b
d) Neither a nor b

3. Which of 4 options below is an example of ITS?
a) Eco Driving support
b) Helmets for motorcyclists
c) Traffic lights
d) Road Signs

4. C-ITS is a short name for?
a) Communication Intelligent Transport Systems
b) Cooperative Intelligent Transport Systems
c) Connective Intelligent Transport Systems
d) Cooperative Intelligent Transport Services

5. Which of the following is NOT a type of C-ITS?
a) V2V
b) I2V
c) V2B
d) V2X

6. What does DSRC stand for?
a) Dedicated Service Road Communication
b) Direct Short Range Communication
c) Dedicated Short Range Communication
d) Direct Service Road Communication

7. Road user charging and variable message signs are all examples of _____ based ITS services
a) Infrastructure
b) Vehicle
c) Public Transport
d) Urban

5.2.2.2. Test 2: ITS and C-ITS for professional drivers

1. CPC stands for?
e) Certified Professional Coder
f) Certificate of Professional Competence
g) City Planning Commission
h) Climate Prediction Centre

2. Which of these is not a benefit related to ITS and C-ITS services for professional drivers?
a) Safety of freight
b) Universal driver's license
c) Better lead time
d) Comfort

3. Which of these is not an ITS services for professional drivers?
a) Dynamic navigation system
b) Eco-driving assistance
c) Cooperative Adaptive Cruise Control
d) Blind spot information system

4. Which of these is not a C-ITS service for professional drivers?
a) Green Light Optimal Speed Advisory (GLOSA)
b) Cooperative Adaptive Cruise Control (CACC)
c) Urban Parking Availability (UPA)
d) Adaptable Headlights (AH)

5. Speed alert system (SAS) helps a driver
a) to monitor speed of a vehicle
b) to monitor and keep speed within the recommended limits
c) to warn other road users about breaching speed limits by a driver of a vehicle
d) to help police to identify which vehicle breach speed limits

6. LDW stands for?
a) Local Data Warehouse
b) Last Day Worked
c) Lane Departure Warning
d) Loss Damage Waiver

7. What purpose does GLOSA serve?
a) Advices drivers allowing them to optimise their approach to a traffic light
b) Informs about an accident on the road
c) Warns about approaching emergency vehicle
d) Informs about availability of free parking in urban areas

8. Please indicate the purpose of Cooperative Adaptive Cruise Control service.

a) It provides information on fuel consumption
b) It warns about the unintentional leaving of the lane
c) It detects risky situations involving pedestrians or cyclists
d) It ensures smooth driving through C-ITS equipped intersections

5.2.3. Knowledge test results

During each training two quizzes were run after 'Theoretical' and 'Deployment site C-ITS services' modules to test the level of acquired knowledge. The results of the first quiz on "What is ITS and C-ITS" shows that a total average of correct answers from all provided trainings is 66.64%. The results of the second quiz on "ITS and C-ITS for professional drivers" shows 65.45% of correct answers. It shows that a bit less than 75% of answers were correct. It is also important to indicate here that the participants had only 20 seconds to read and answer each question, by choosing one of four proposed answers. Taking into account a short available time and complexity of some questions, the general average of obtained results is more than satisfactory. It also important to indicate that some participants performed with a very high score.

6. Deployment site training materials

In this part of the deliverable all training materials provided in each DS are presented. Since the first theoretical module is the same for all trainings, only two other modules are presented for they are different for each training.

The practical or testing part of the training follows the theoretical introduction. It mainly depends on the availability of the C-ITS services deployed in each pilot site.

Presentation of all DS trainings and their materials are put following the order on the calendar, i.e. Barcelona was the first to kick off the trainings organised by the C-MobILE partners.

6.1. Barcelona Deployment Site

6.1.1. Description of Barcelona training

Applus+ IDIADA as organizer, RACC as host and IRU as supporter and leader of the training sessions in every site of the project, organized the training for end-users of the Barcelona DS on May 7. All Barcelona's C-MobILE partners and associated partners were engaged 6 months before the training date, as such training was understood to be needed for showing the final users and testing users how the services would look like in Barcelona right before the large-scale deployment.

6.1.1.1. Purpose of the training

Barcelona DS started from scratch in C-ITS and, for such reason, it was scheduled a testing period to validate the services and the application developed prior to the large-scale deployment. In order to increase the awareness of Barcelona's citizens and also the trainers, a 1-2-month period was on the table for that purpose. It was decided to fuse this session with the C-MobILE WP4 training, to have a complete set of sessions under a single training event.

6.1.1.2. Participants of the training

Within Task 4.1, a set of training sessions were planned in every region targeting professional drivers. Barcelona DS's services only target conventional road users, therefore the training session was organized thinking of drivers, riders and cyclists, even though road operators, public authorities and some professional drivers (e.g. performing maintenance works) are also involved.

6.1.2. Deployment site C-ITS services module

6.1.2.1. Purpose of the module

This session gives an overview of the C-MobILE services available in the Barcelona DS, as well as some descriptions regarding the testing and large-scale phases. It is especially important as the next session is a showcase of this one and, considering that the sessions are conducted in Spanish language and most of the terms and words from C-MobILE are in English, this session takes especial relevance.

It is not intended that users know all services' names and what they can bring to them, but they should remember the type of information they are going to enjoy while driving/riding with the Barcelona's C-MobILE application. This is the main purpose of this session.

6.1.2.2. Description of covered materials

"About" section where it is emphasized the importance of the large-scale deployment for C-MobILE. This is especially important as everything designed, organized and implemented within the project has been led by this large-scale target. Attendees need to understand that the ambition of C-MobILE goes beyond piloting or testing the services during a short period of time.

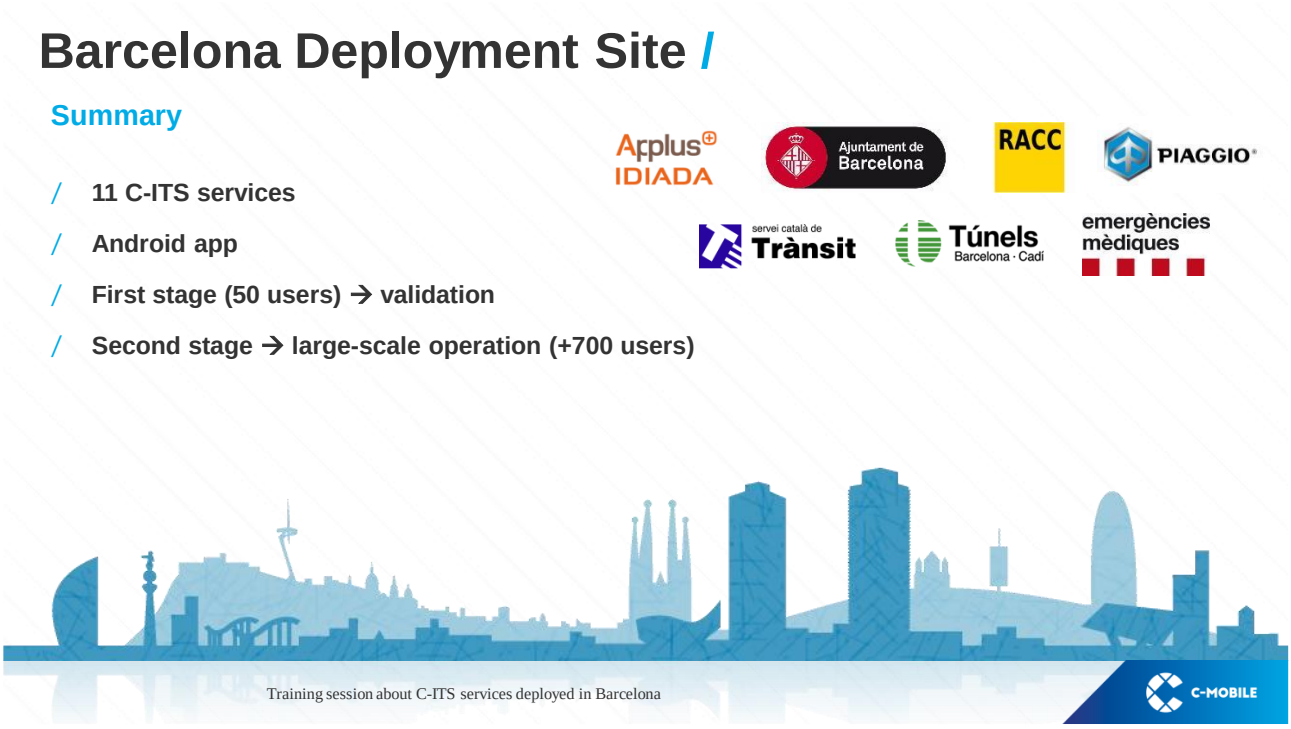


Figure 24: Barcelona DS

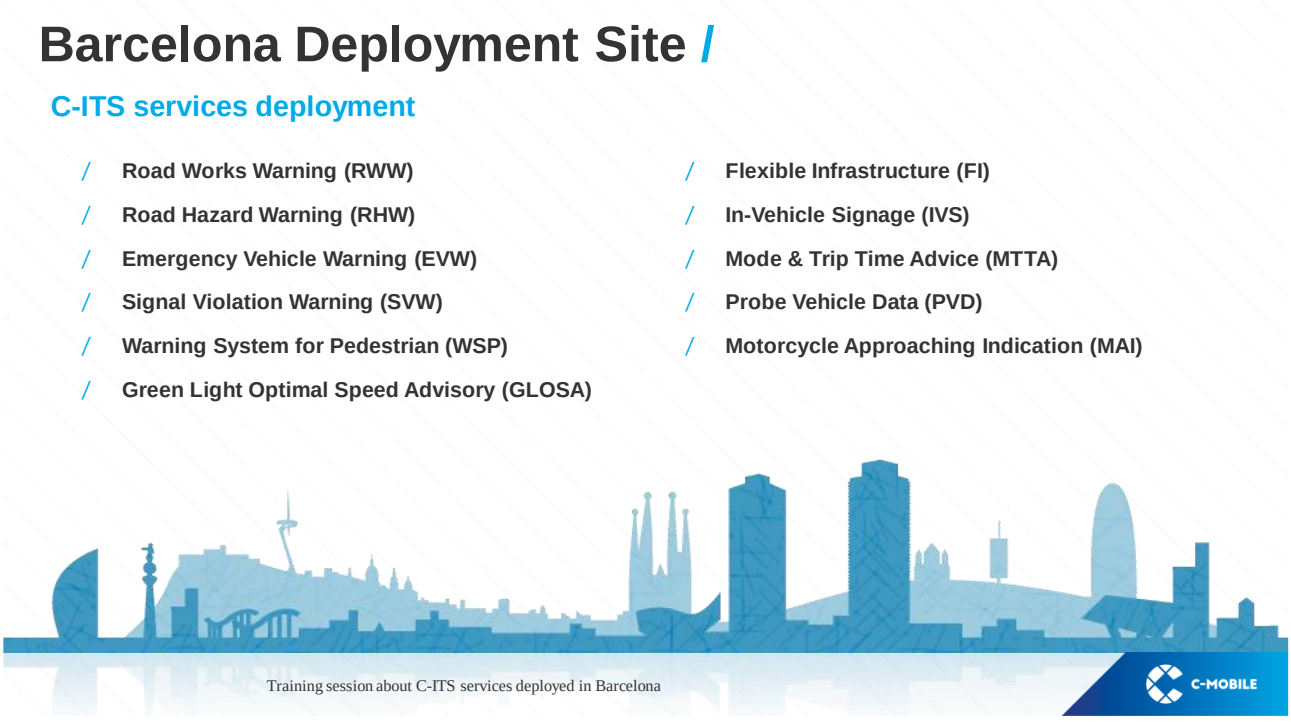


Figure 25: C-ITS services in Barcelona DS

For the first time, the users/citizens have an overview of the Barcelona DS in terms of the number of services available, the way they enjoy the services and the different phases planned for the DS.

Short description of the safety services is presented in this slide. There is not much time wasted on it as in the practical module they will notice the services from a more interactive way, which will make them remember the services easier than from the name and the short description.

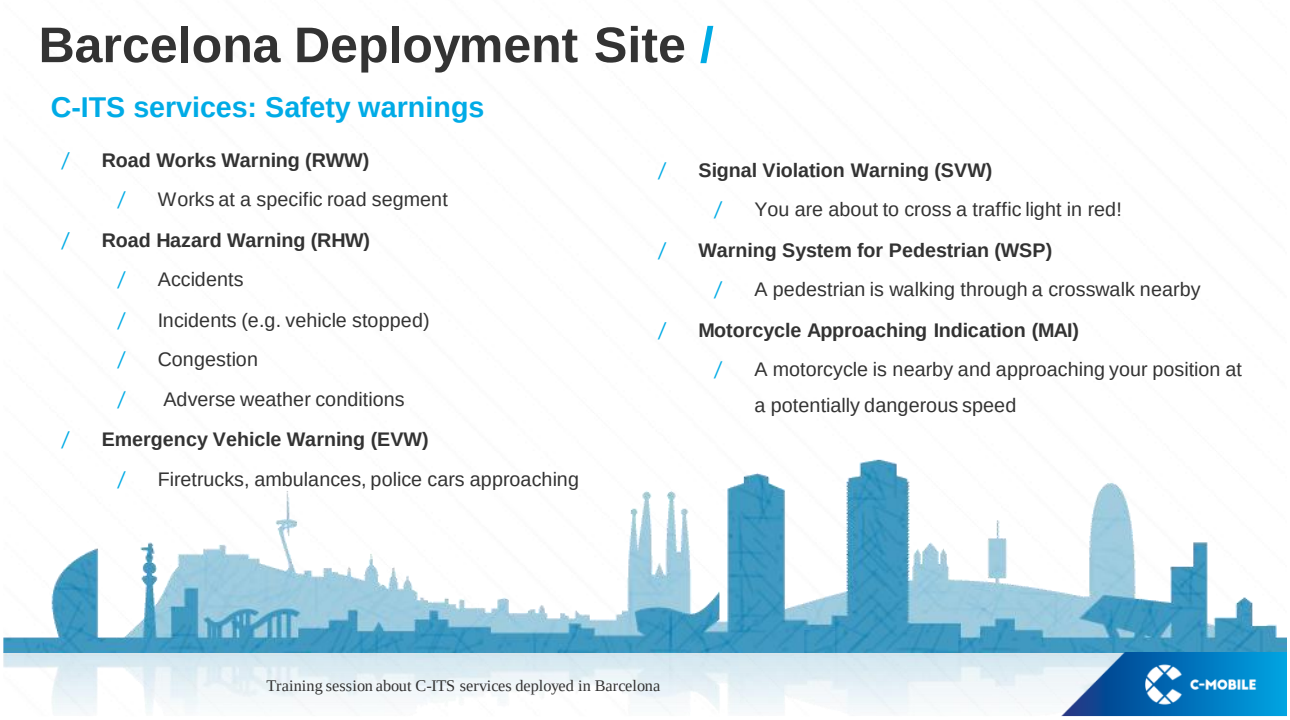


Figure 26: Safety warnings

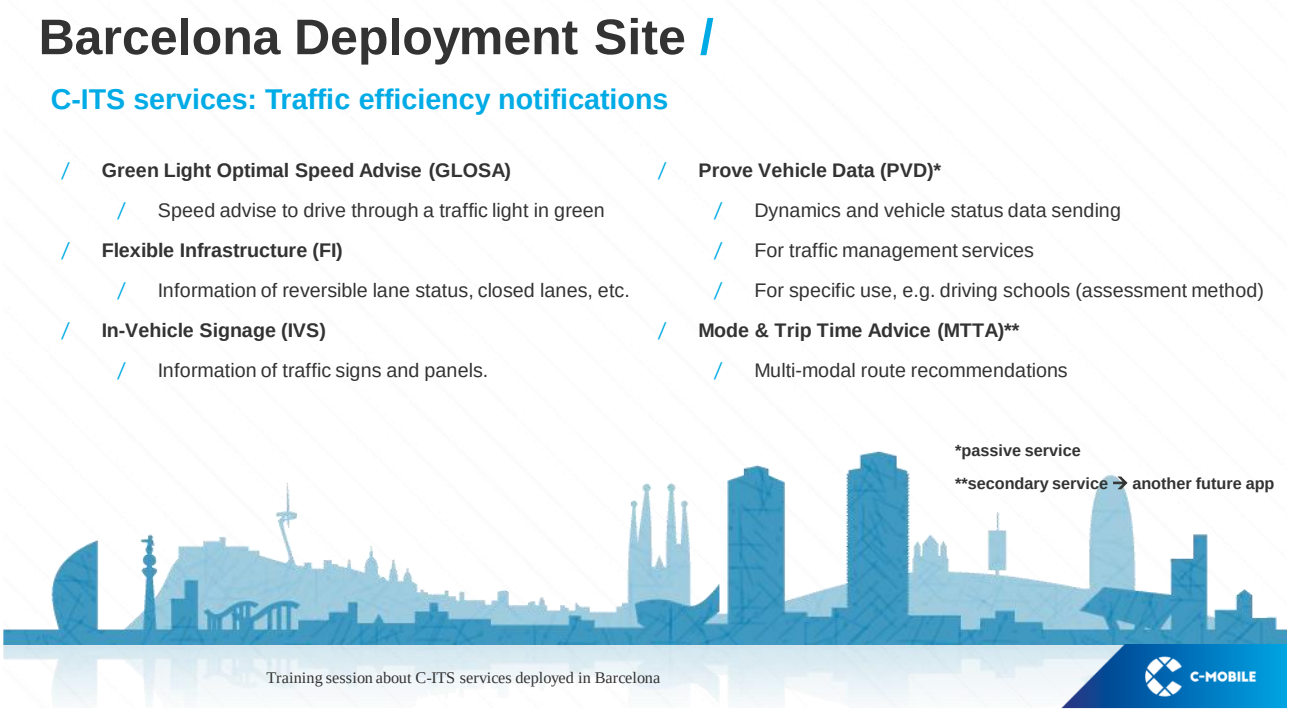


Figure 27: Traffic efficiency notifications

Short description of the efficiency services is presented in this slide.

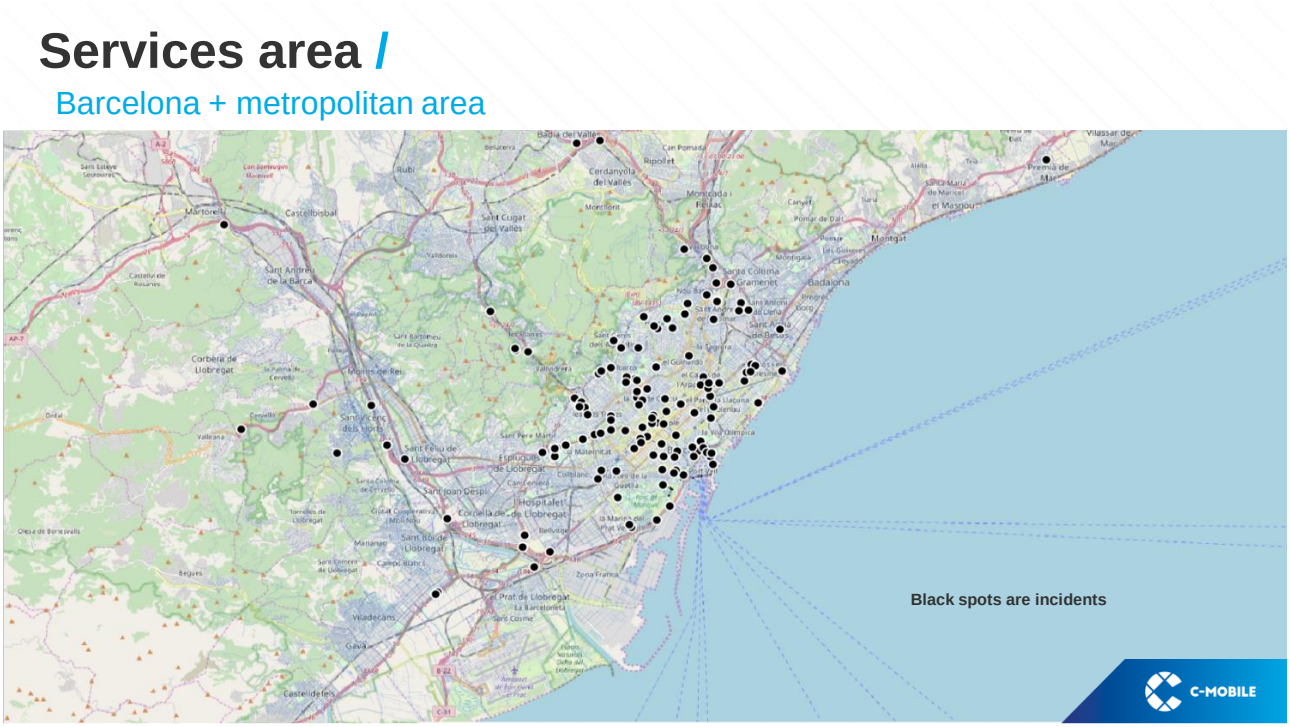


Figure 28: Services area

Coverage area of the Barcelona DS, emphasizing that not only Barcelona city will be covered, but also the part of the metropolitan area in order to provide information for those who get in and out the city.

Figure 29: Users recruitment and participation

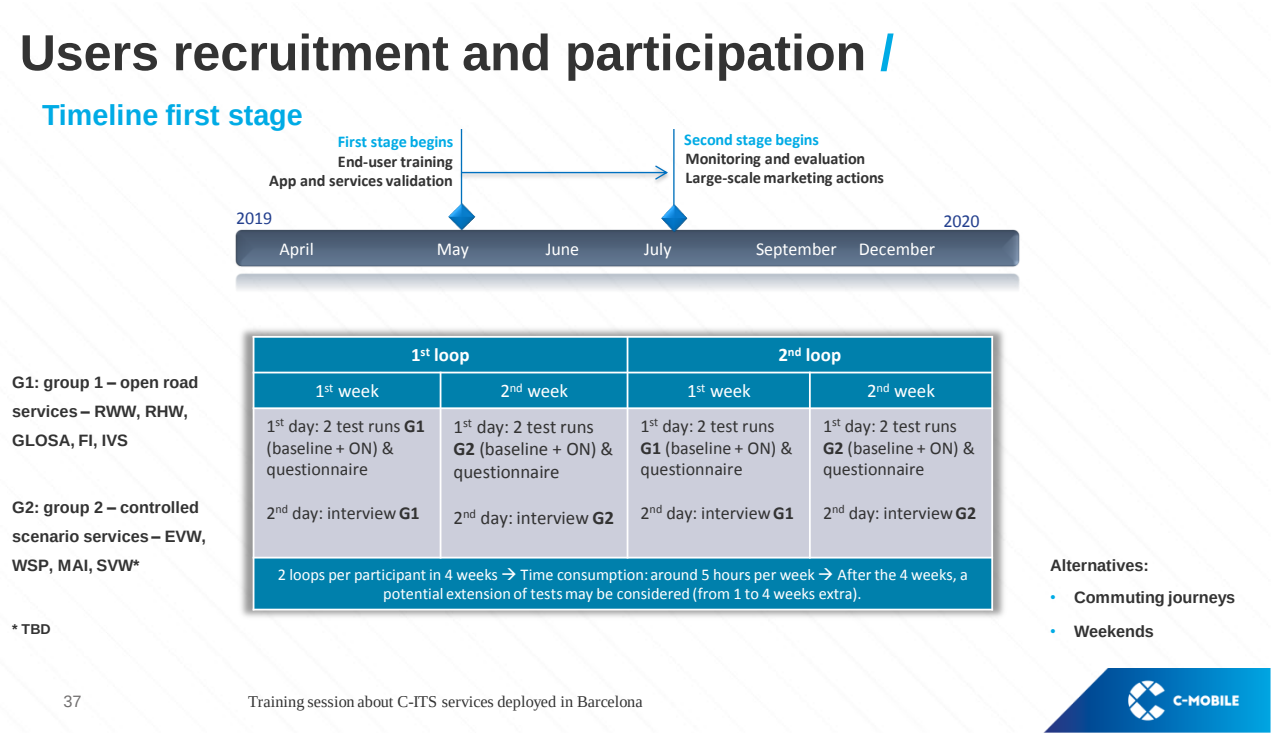


Figure 30: Timeline and first stage

After presenting the deployment, the last 2 slides introduce the users into the testing period. How they will participate, the information they will be given and will give as feedback. It includes a reference calendar where they realize about the initial idea of testing the services following different runs for also creating baseline data. The services are also differentiated depending on the testing needs, whether they can be tested freely or by forcing the situation.

6.1.3. Practical module

6.1.3.1. Purpose of the module

The practical session is understood as the most important one. As the development of the Barcelona DS is still on progress, there was no chance to show the services on live, so the session was prepared to show the services with some videos. The idea behind the videos is to reproduce the situation of the users driving along a road in Barcelona when, suddenly, an event is displayed on the screen of their smartphones. Also, they pretend to show the different screen and options the app is offering.

6.1.3.2. Description of covered materials

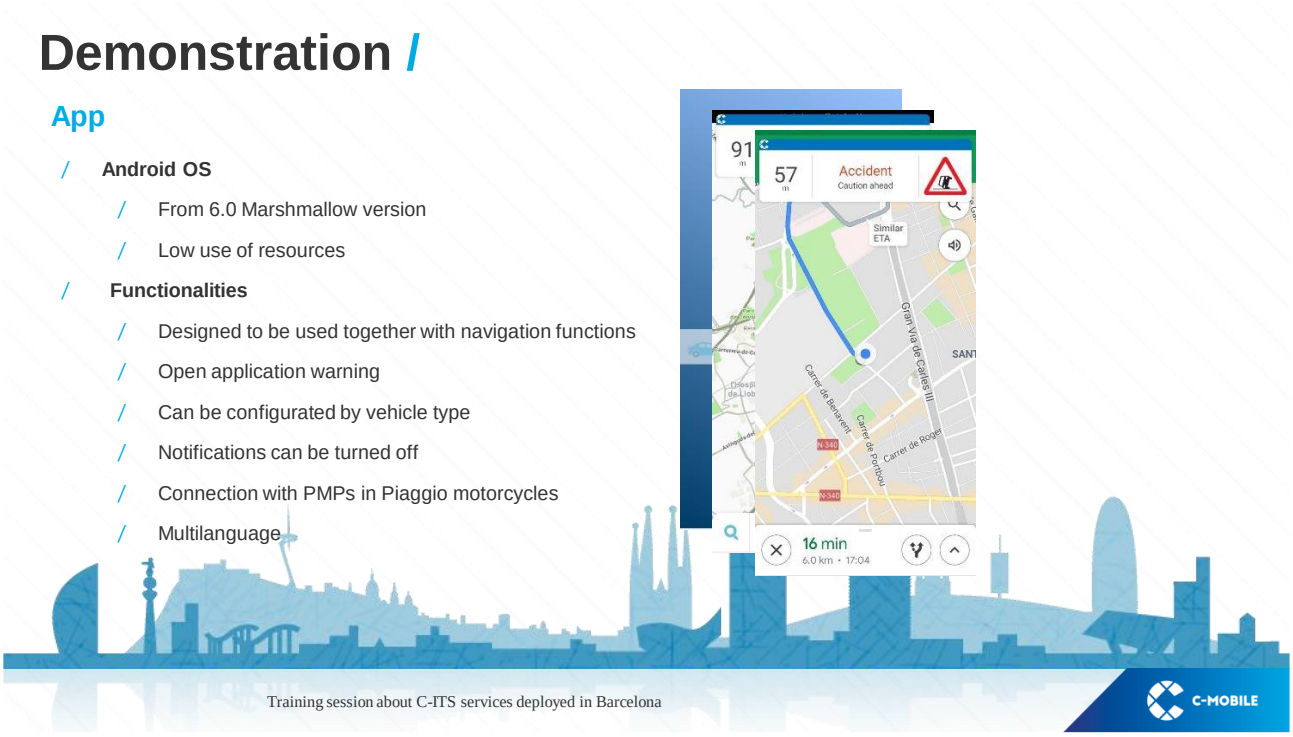


Figure 31: Demonstration

Introduction of the application, main functionalities, characteristics and future features. A video is included showing the app icon, main and settings screen. The video also shows that, since the app is working on background almost all the time, there is a notification indicating the app is running while it is used together with other apps.

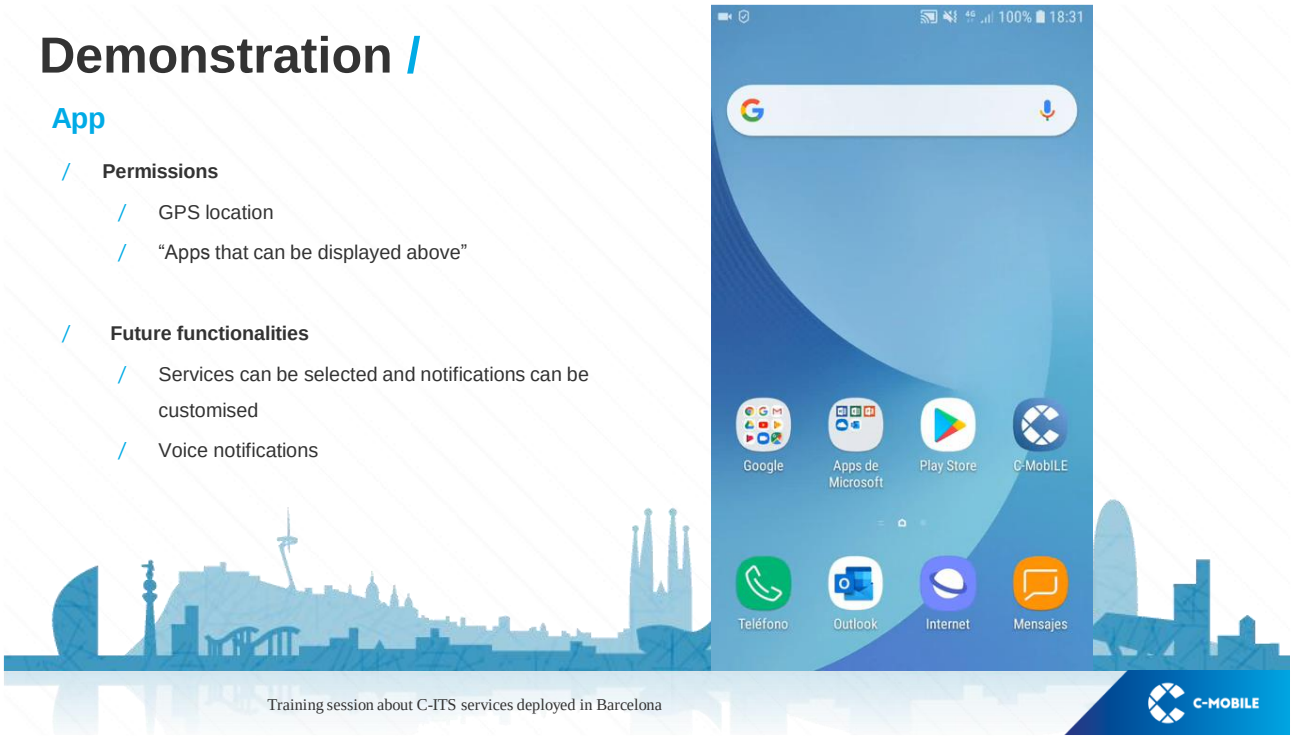


Figure 32: Demonstration of app

A video is included showing the app icon, main and settings screen. The video also shows that, since the app is working on background almost all the time, there is a notification indicating the app is running while it is used together with other apps.

Slide showing a case of Road Works Warning (RWW) service. The slide includes when the RWW are expected to be received by the driver and also a video showing the RWW notification while driving on a main road in Barcelona.

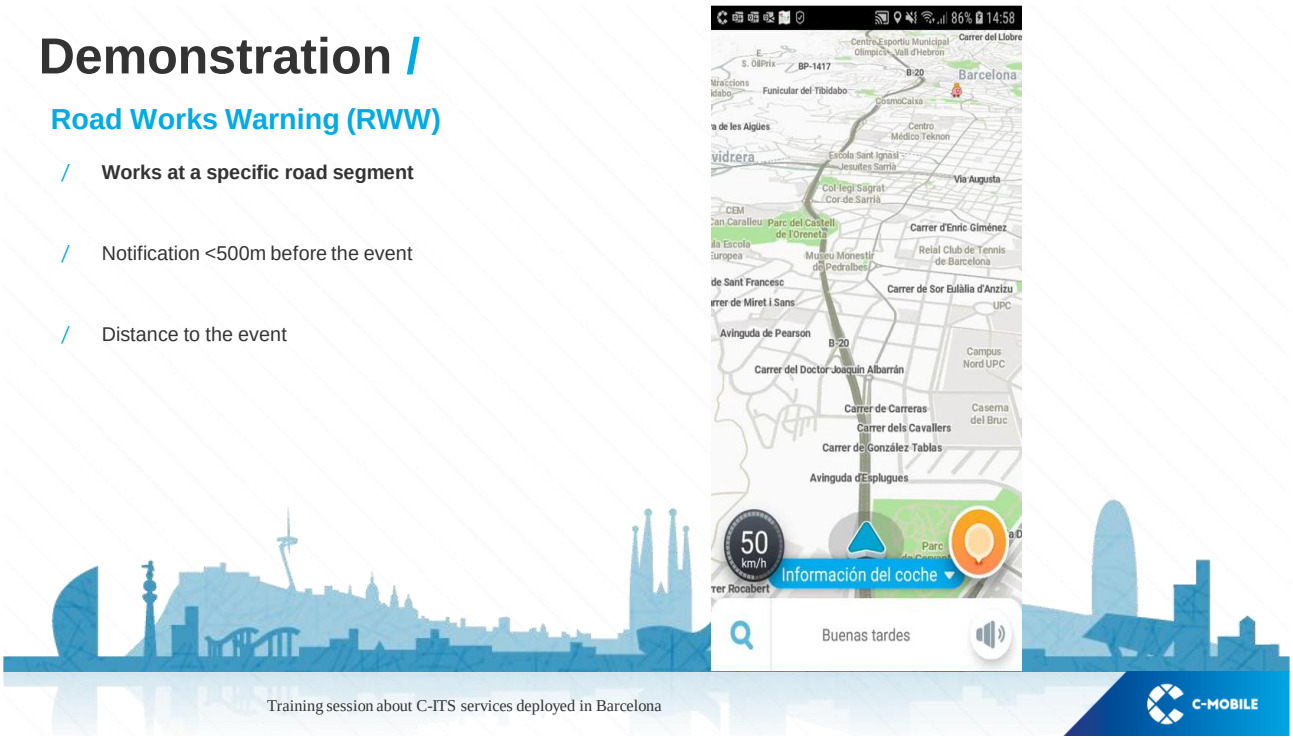


Figure 33: Road Work Warning (RWW)

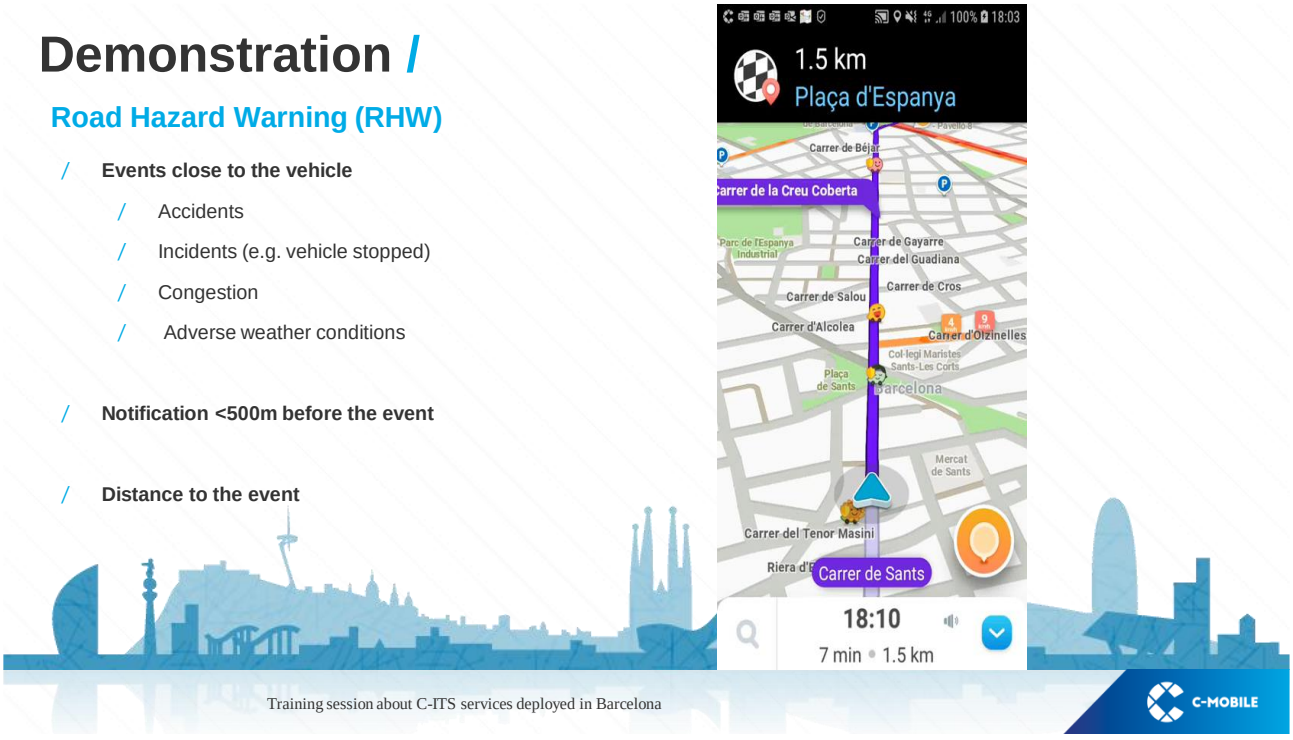


Figure 34: Road Hazard Warning (RHW)

Road Hazard Warning (RHW) service is presented in this slide. Some information is shown regarding the different hazards types available in Barcelona and how in advance the notification will be presented.

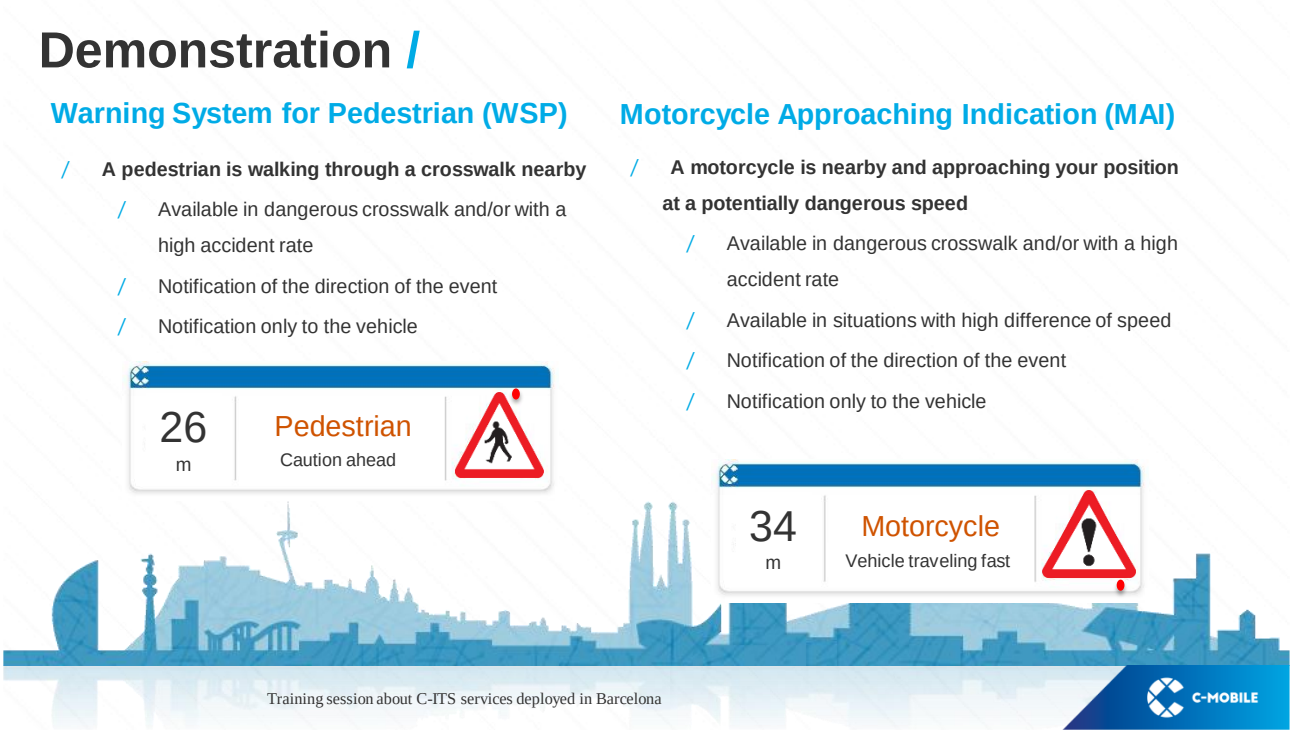


Figure 35: WSP and MAI

This slide presents two services that are quite equal in terms of notification design and experience. Warning System for Pedestrian (WSP) and Motorcycle Approaching Indication (MAI) are safety services that raise awareness with the drivers that there is a motorcycle or a pedestrian nearby. In this case no videos are available, but an example of the notification is presented, as well as the different features and deployment areas where those services will be available in Barcelona.

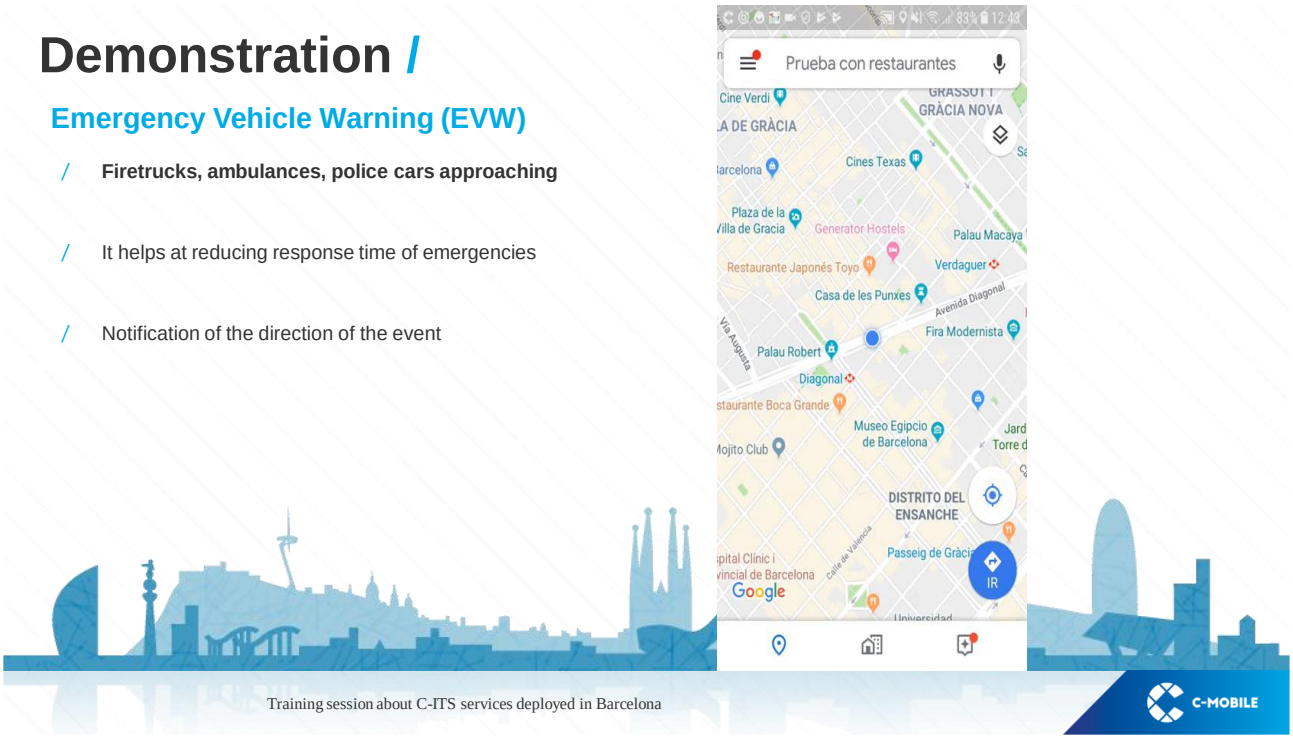


Figure 36: Emergency Vehicle Warning (EVW)

Emergency Vehicle Warning (EVW) service is presented in this slide, where information is available on the purpose and importance of this service for fast emergency response. A video is shown with a use case where a vehicle is driving on a main road and an EV is approaching it. The video shows how the notification also gives you an indication on where the EV is coming from, so the driver can clear the way faster.

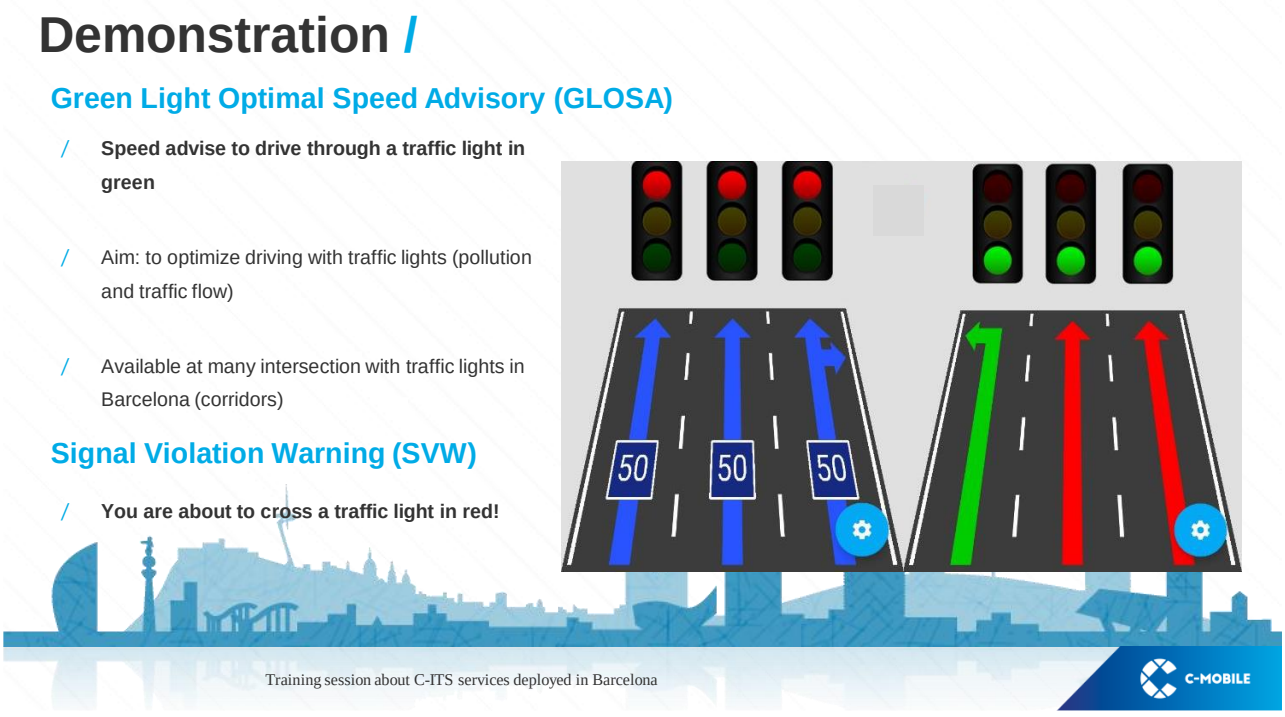


Figure 37: GLOSA

This slide shows the services related to the traffic lights. GLOSA and Signal Violation Warning (SVW) are introduced and an example of the notification is presented. Some examples of real cases are explained to make the attendees understand how these services can optimise the whole traffic around an intersection.

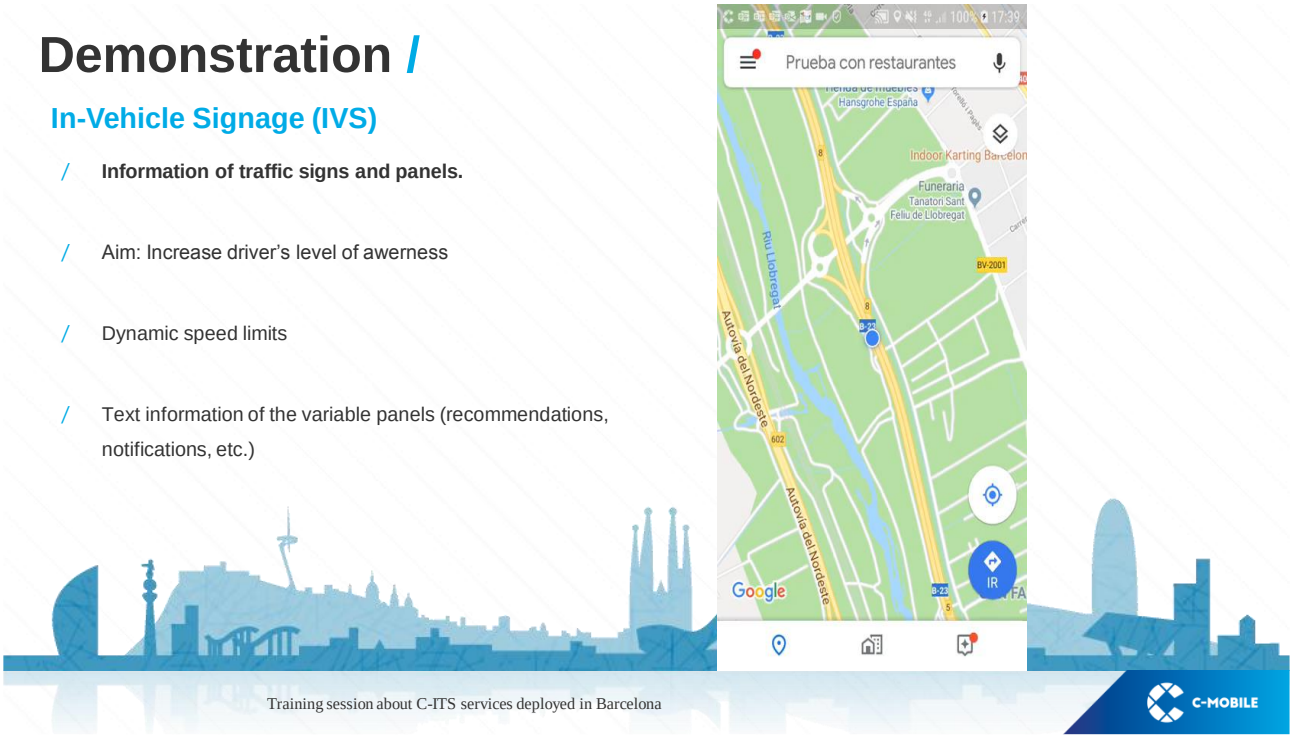


Figure 38: In-Vehicle Signage (IVS)

In-Vehicle Signage (IVS) service is presented in this slide. The different types of information available is shown, as well as video which shows a maximum speed limit notification.

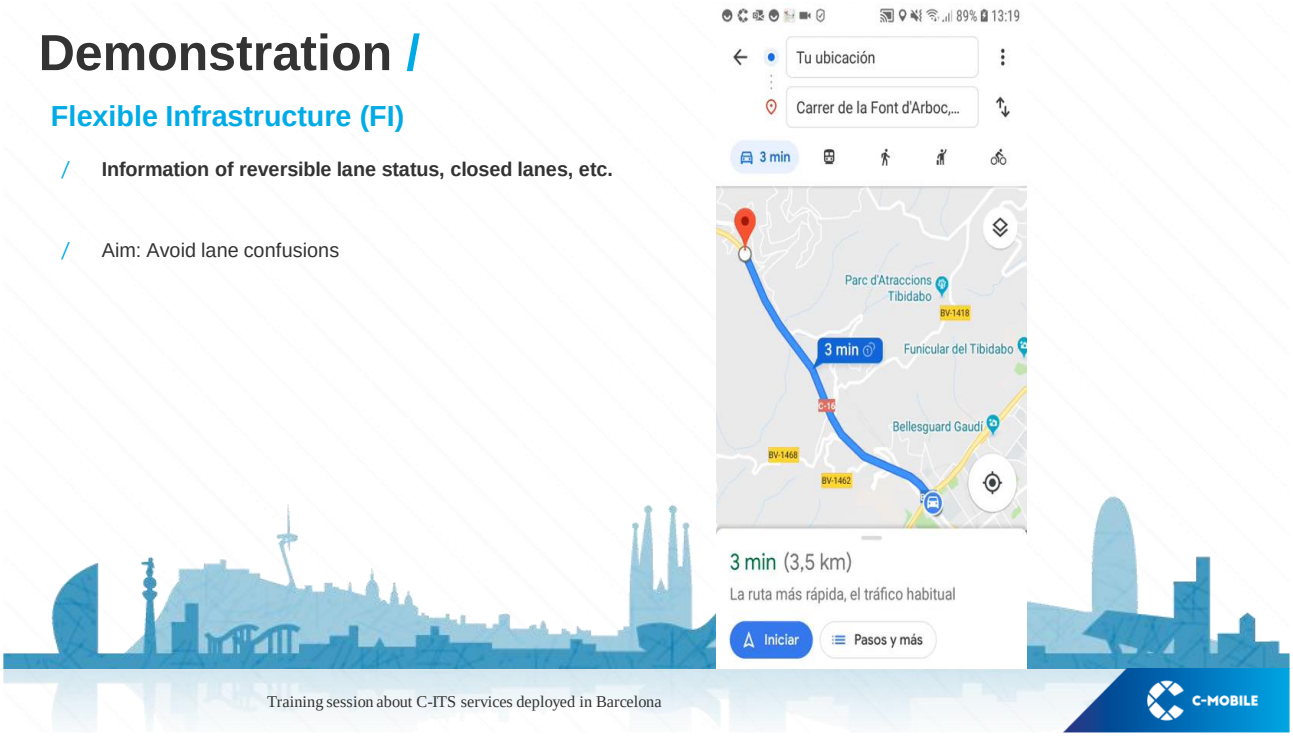


Figure 39: Flexible Infrastructure

The Flexible Infrastructure (FI) service, to be available in a main road connecting Barcelona city to other surrounding cities, is presented in this slide. The video shows how a driver is informed about the status of the lanes of such road once he/she approaches it.

Figure 40: Flexible Infrastructure

The application also allows the user to change its role, from driver, rider, cyclist to pedestrian. The C-MobILE user-based bundling approach is also introduced. In general, this slide emphasized the importance of the user roles in the app and the project.

6.2. Bordeaux Deployment Site

6.2.1. Description of Bordeaux training

NeoGLS, as organizer and leader of the training sessions of Bordeaux pilot site, organize a training on the 14th of June. All Bordeaux's C-MobILE partners were engaged these last months to ensure the smooth running of the project, its use cases and its evaluation.

6.2.1.1. Purpose of the training

Bordeaux has big mobility problems, particularly with heavy traffic congestion, especially at peak times. Thanks to the application and the C-MobILE cases of uses, the objective is to manage and to solve these problems. By educating professional drivers in addition to the general public, we have hope to achieve this goal.

6.2.1.2. Participants of the training

The general public is already aware of the use of the application. Now, we want to sensitize professional drivers (road hauliers in particular) to ensure a greater impact on mobility in Bordeaux and its surroundings.

6.2.2. Deployment site C-ITS services module

6.2.2.1. Purpose of the module

This session pretends to give an extensive overview of the C-MobILE use cases available in the area of Bordeaux, as well as some descriptions regarding the testing and large-scale phases of deployment and development. We will talk about what each use case can bring to the general public and the professional drivers during their daily trips, and how much it is comfortable to drive with such as an innovative driving aid.

6.2.2.2. Description of covered materials

Introduction of the C-MobILE training session.

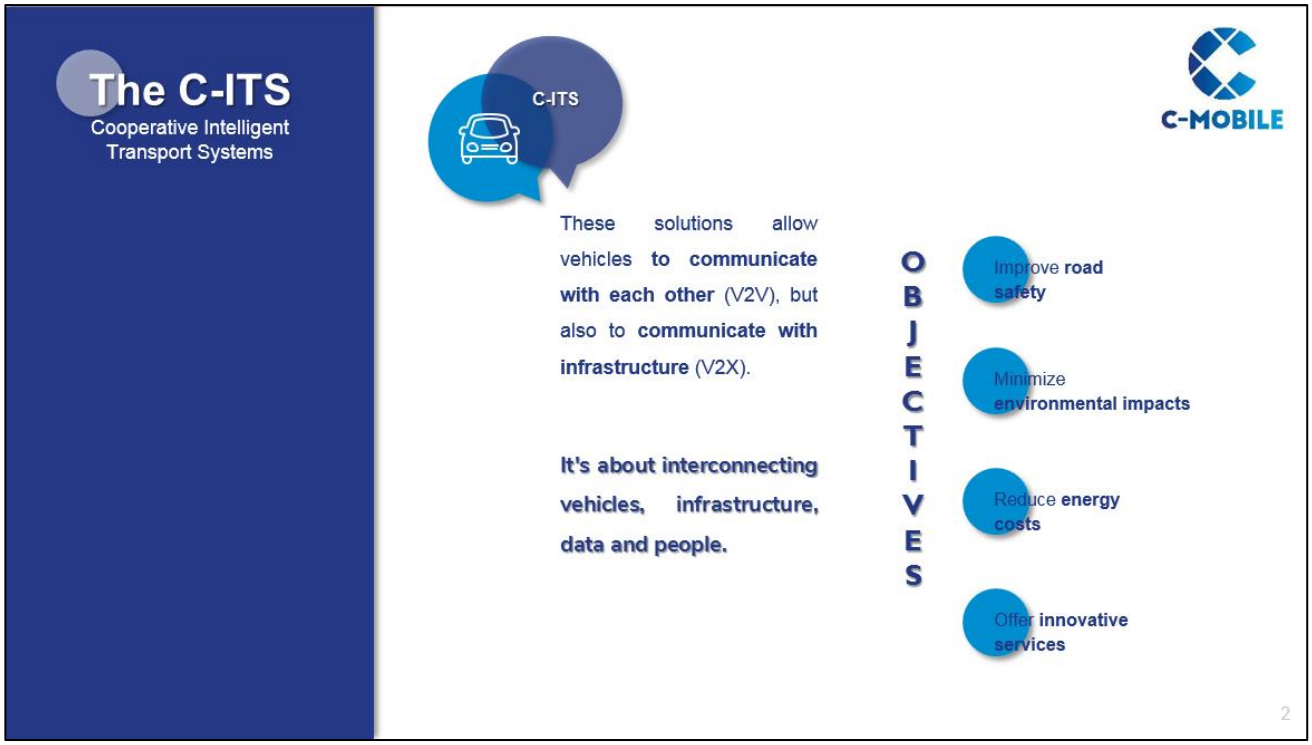


Figure 41: C-ITS solutions

Quick reminder about what are the C-ITS solutions, what they allow and their objectives in terms of road safety, environmental impacts, energy costs and innovative services.

Presentation of the driving aid application which provide C-ITS use cases to road drivers in their daily trips in Bordeaux. Main functionalities, characteristics, etc.

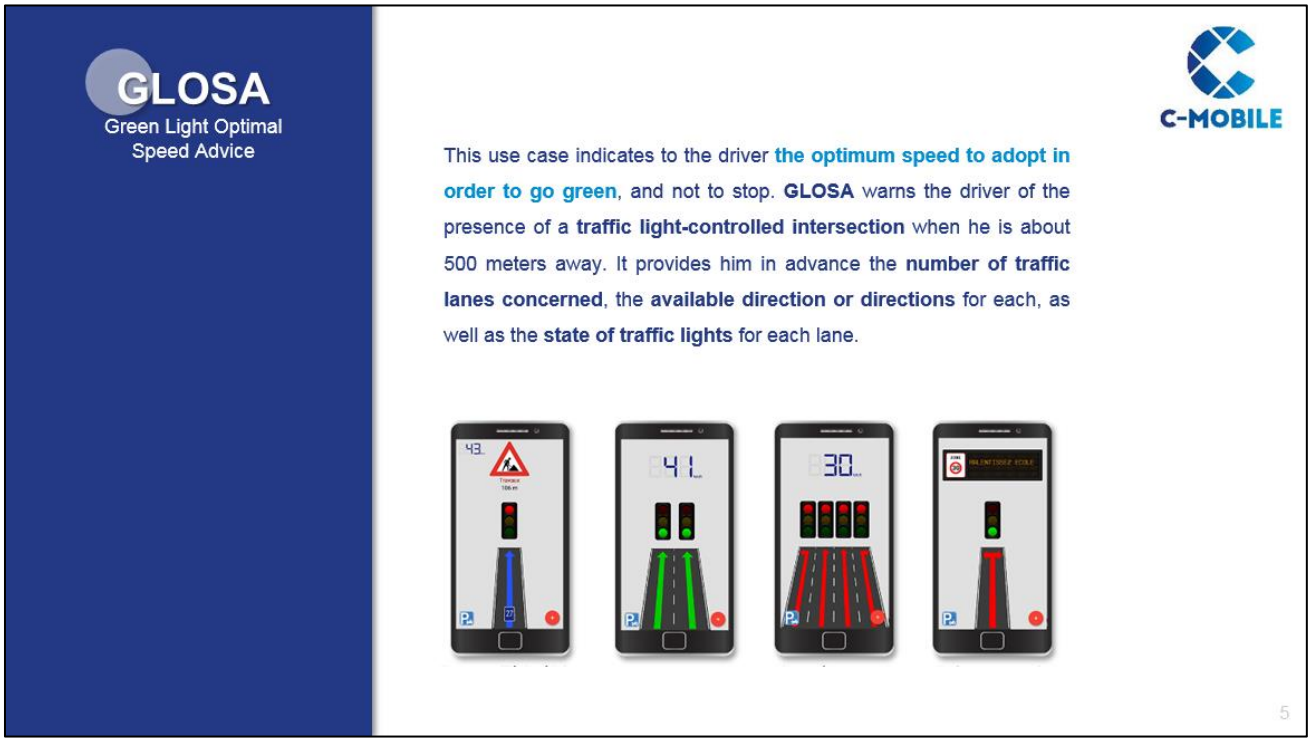


Figure 42: GLOSA

GLOSA is a traffic service allowing you to adapt your driving according to the state of traffic lights. GLOSA is an innovative service, indicating to the driver the optimal speed to adopt to catch the green traffic light, and so not to stop.

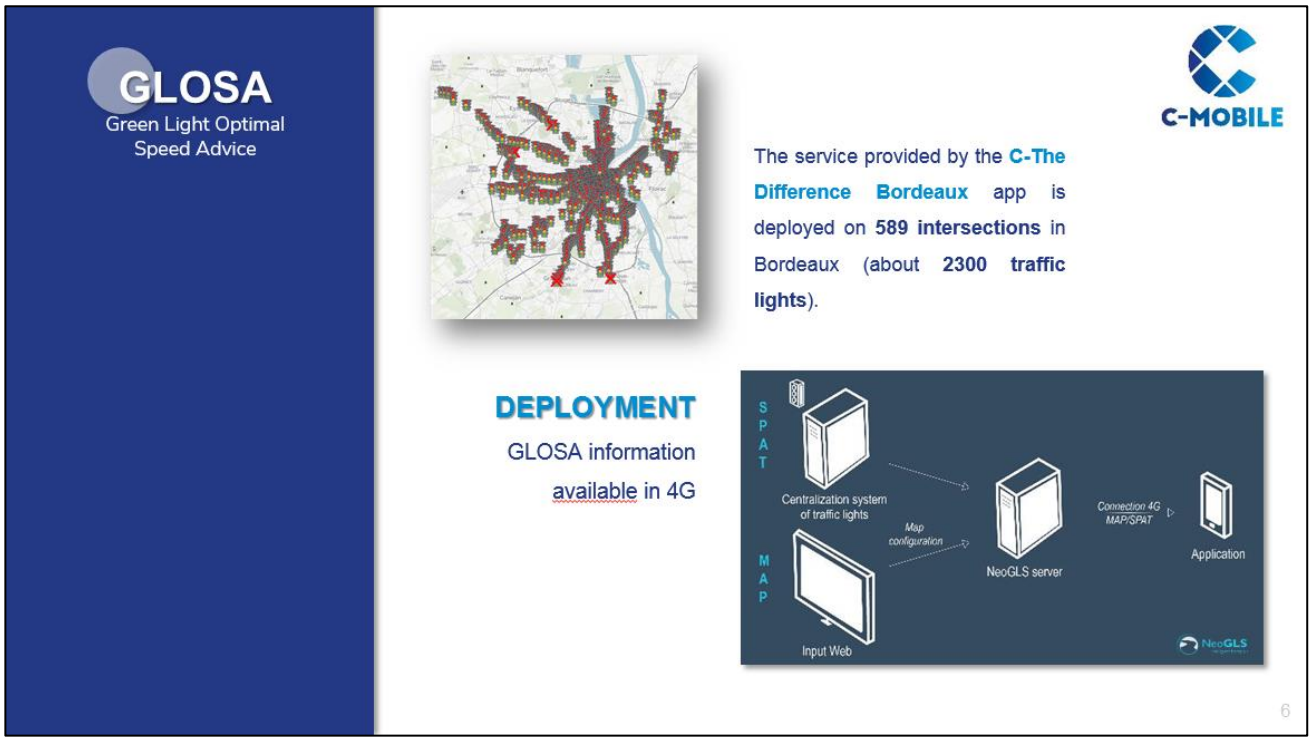


Figure 43: GLOSA in Bordeaux

The functioning is simple: GLOSA service allows to warn the driver of the presence of a crossroads with traffic lights when he is at around 500 meters from it. It supplied in advance the number of traffic lanes, the available directions for each, as well as the state of

the traffic light for every lane. If the traffic light is red and that it will pass to the green, GLOSA can advise the driver to slow down to adopt a certain speed to arrive at the crossroads when the light will pass to the green.

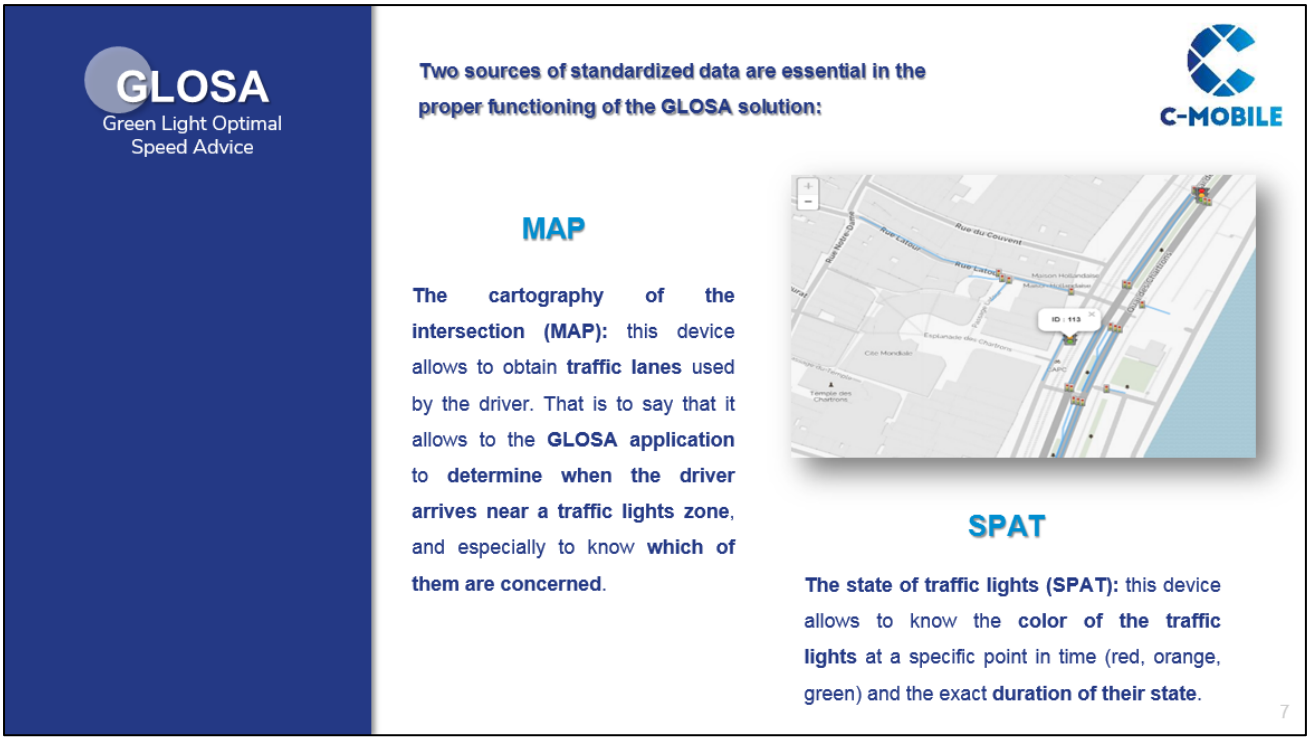


Figure 44: Sources of standardized data for GLOSA

Two sources of standardized data are essential in the proper functioning of the GLOSA solution:

The cartography of the intersection (MAP): this device allows to obtain traffic lanes used by the driver. That is to say that it allows the GLOSA application to determine when the driver arrives near a traffic lights zone, and especially to know which of them are concerned.

NeoGLS generates the cartography from the data transmitted by the centralization system of the traffic lights of the concerned city (Gertrude in Bordeaux), by retranscribing them on our input tool. These data include the identifiers of all the traffic lights, the speed limit of the traffic lanes and the possible actions (turn left, turn right, continue straight).

The state of traffic lights (SPAT): this device allows to know the colour of the traffic lights at a specific point in time (red, orange, green) and the exact duration of their state.

There are 2 different ways to get the data of the state of the traffic lights (SPAT): directly by the local controllers of traffic lights and by systems of centralized management of traffic lights. These two devices transmit the data concerning the state of the traffic lights according to their identifier, either to the RSU (Road Side Unit), or directly to the application, or to a hybrid solution of these two cases.

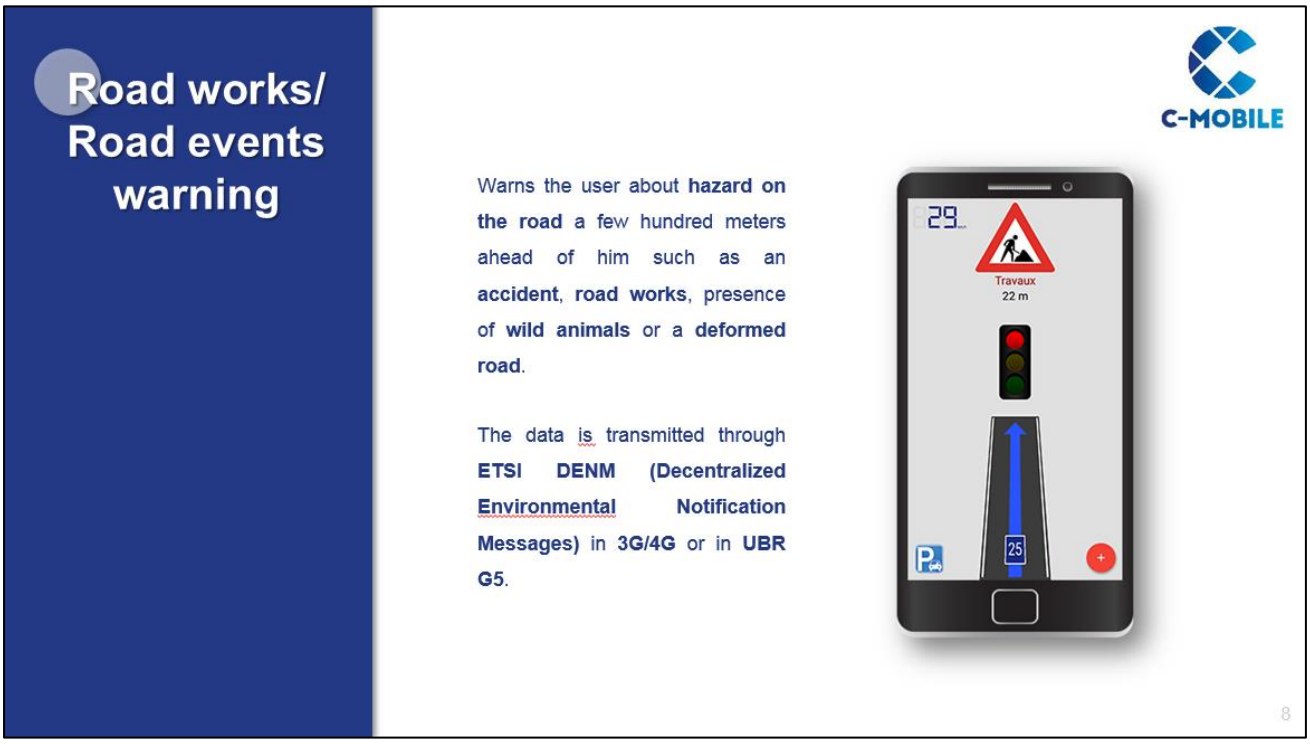


Figure 45: Road Works/Road events warning

Description of the use case “road hazards and road works warning” and its functioning: Warns the user about hazard on the road a few hundred meters ahead of him such as an accident, road works, presence of wild animals or a deformed road. The data is transmitted through ETSI DENM (Decentralized Environmental Notification Messages) in 3G/4G or in UBR G5.

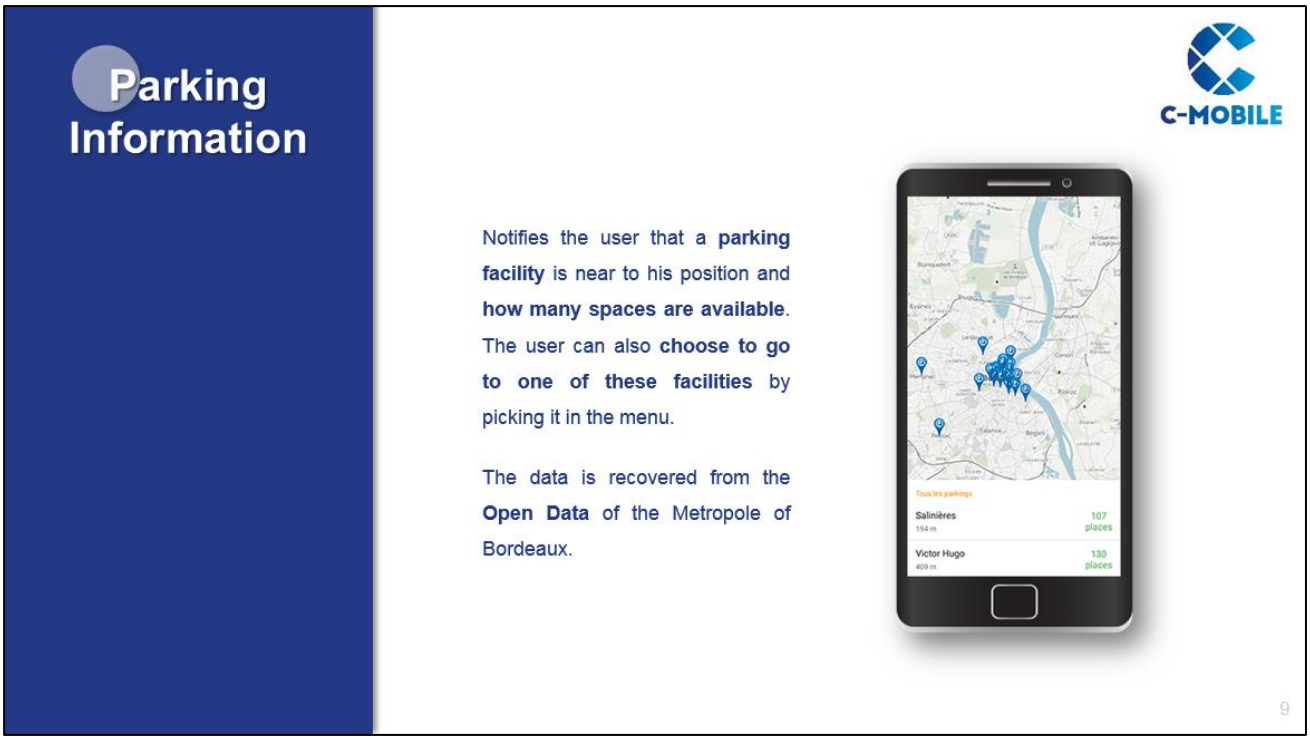


Figure 46: Parking Information

Description of the use case “parking information” and its functioning: Notifies the user that a parking facility is near to his position and how many spaces are available. The user can also choose to go to one of these facilities by picking it in the menu. The data is recovered from the Open Data of the Metropole of Bordeaux.

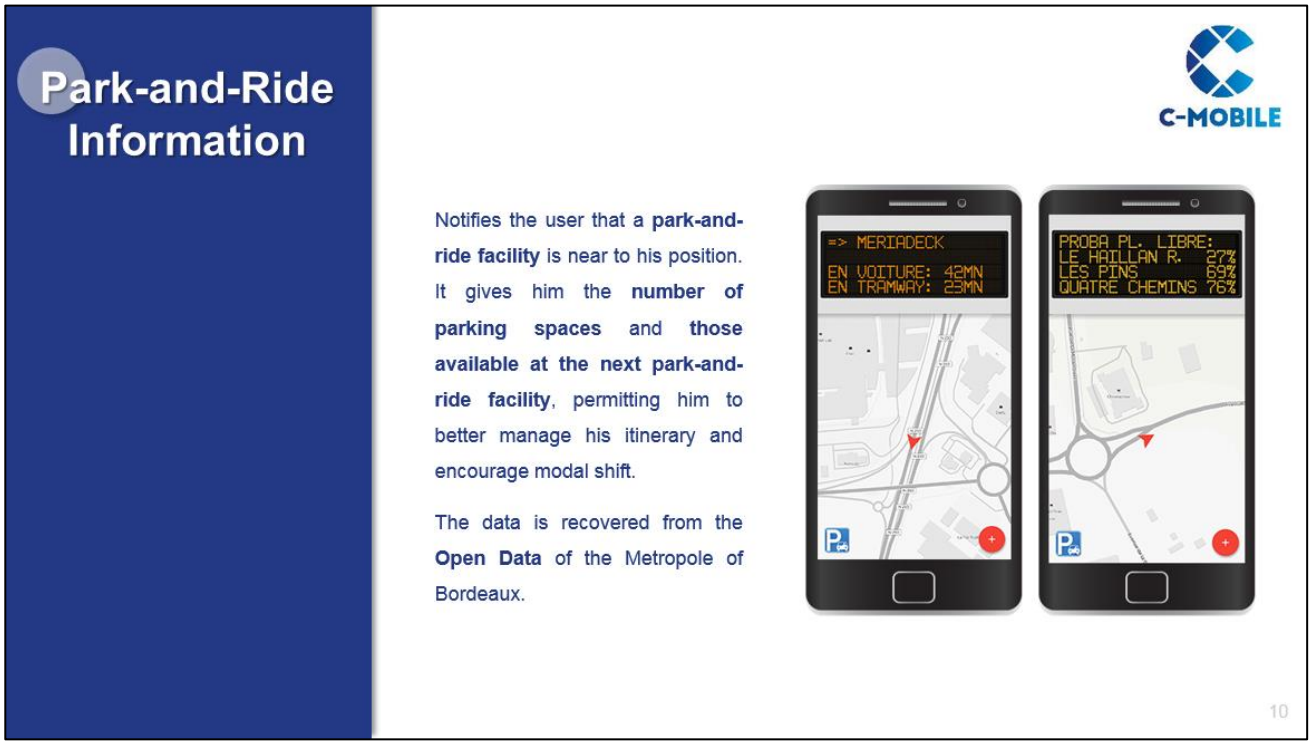


Figure 47: Park-and-Ride Information

Description of the use case “parking information” and its functioning: notifies the user that a parking facility is near to his position and how many spaces are available. The user can also choose to go to one of these facilities by picking it in the menu. The data is recovered from the Open Data of the Metropole of Bordeaux. Description of the use case “park and ride information” and its functioning: notifies the user that a park-and-ride facility is near to his position. It gives him the number of parking spaces and those available at the next park-and-ride facility, permitting him to better manage his itinerary and encourage modal shift.

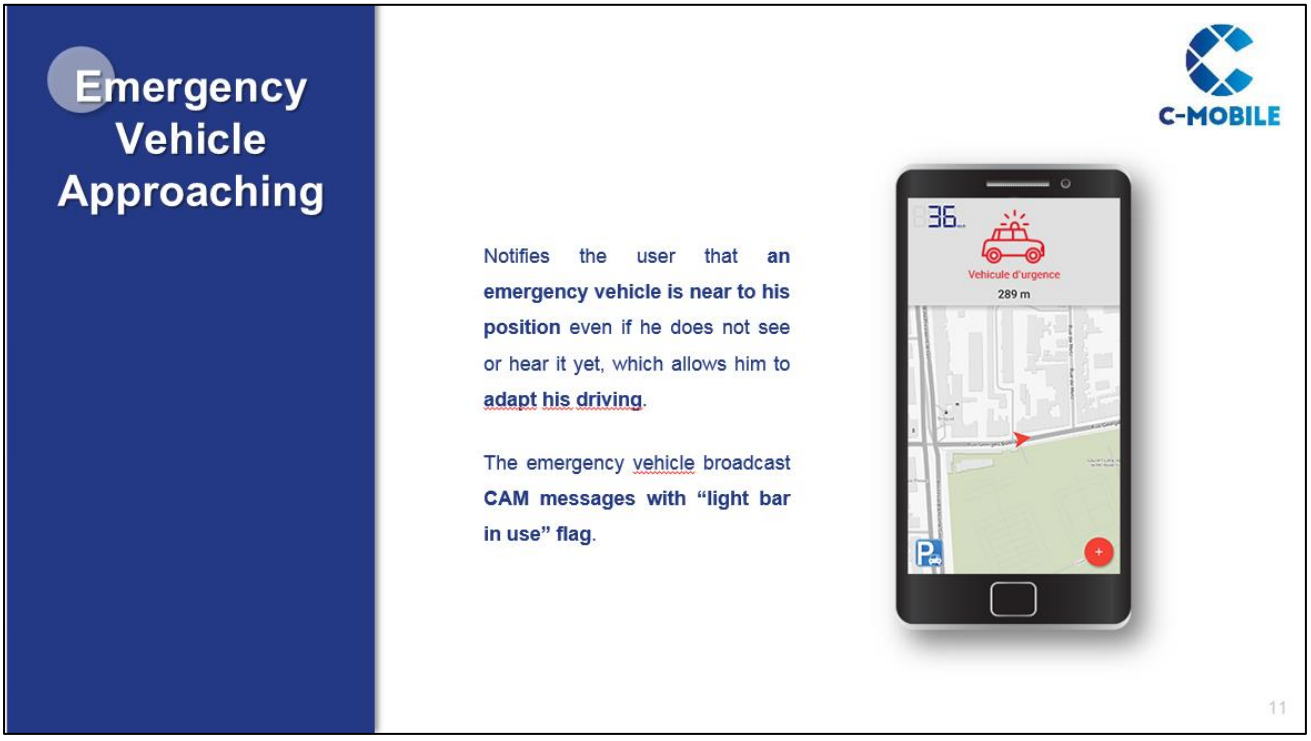


Figure 48: Emergency Vehicle Approaching

Description of the use case “emergency vehicle approaching” and its functioning: notifies the user that an emergency vehicle is near to his position even if he does not see or hear it yet, which allows him to adapt his driving. The emergency vehicle broadcast CAM messages with “light bar in use” flag.

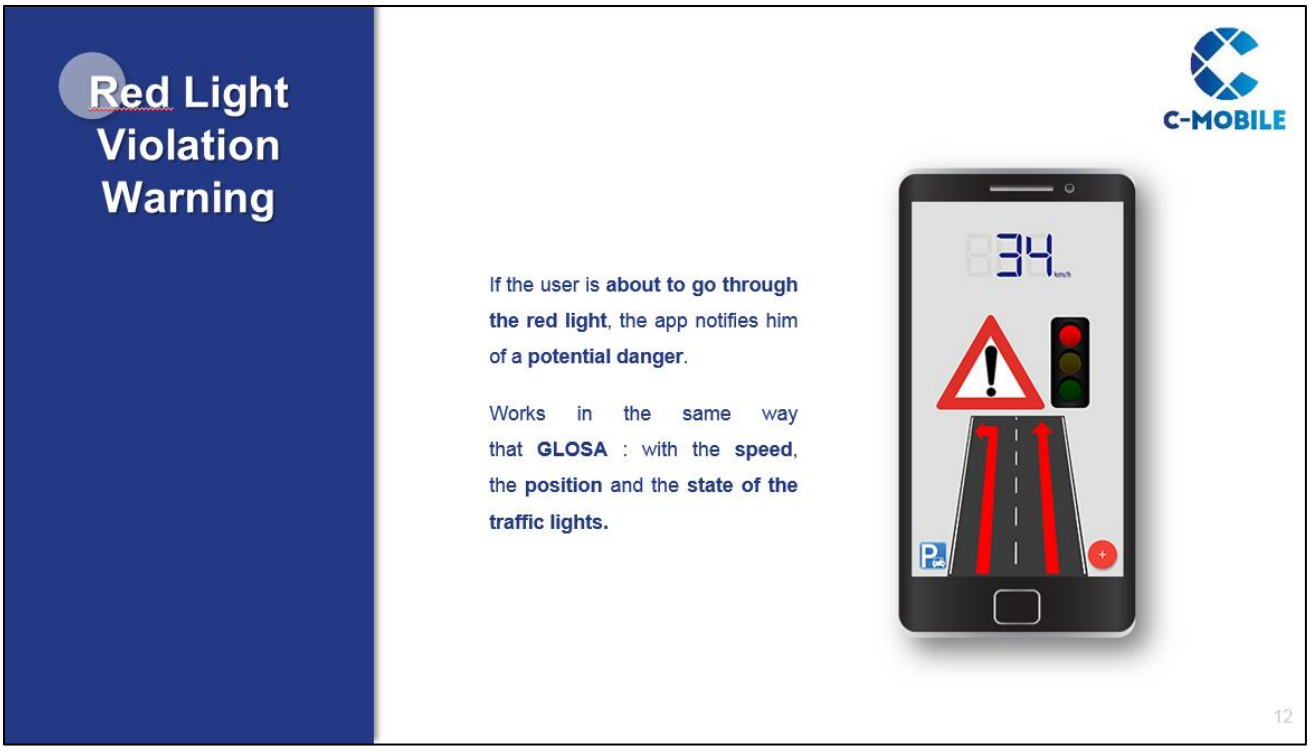


Figure 49: Red Light Violation Warning

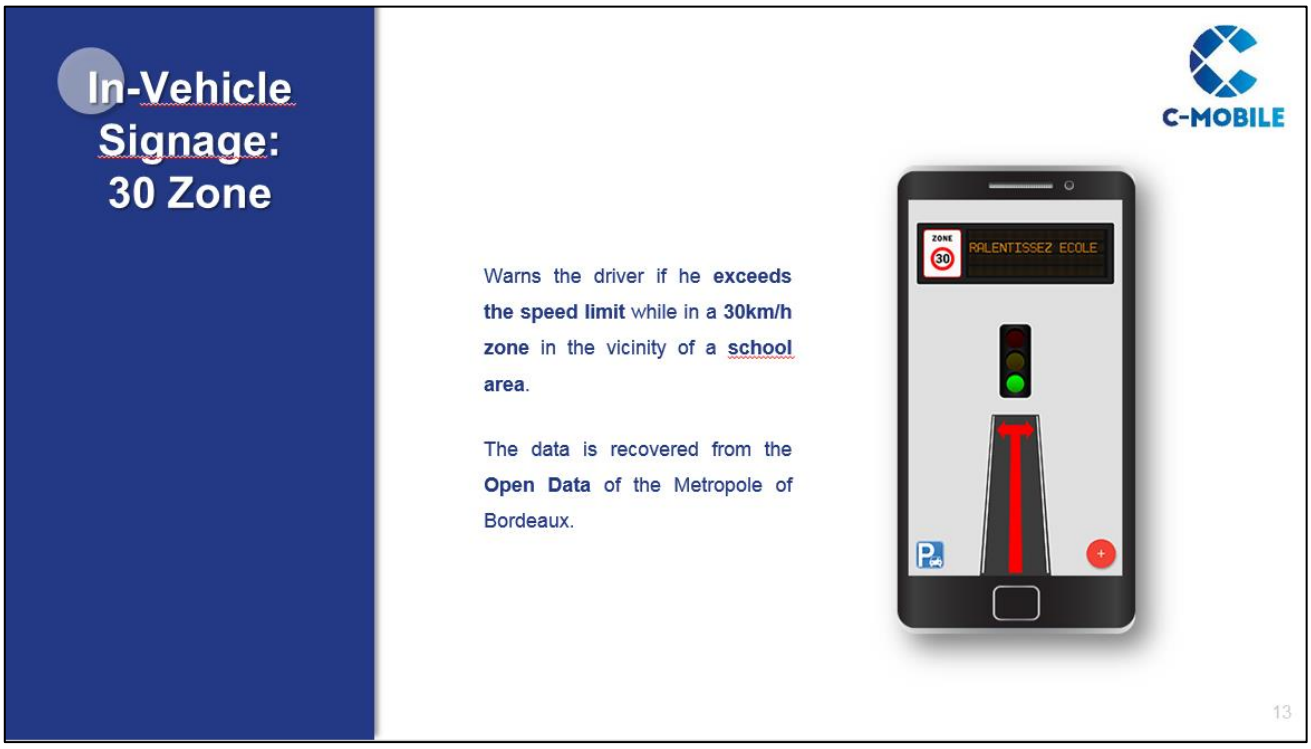


Figure 50: In-Vehicle Signage

Description of the use case “red light violation warning” and its functioning: If the user is about to go through the red light, the app notifies him of a potential danger. Works in the same way that GLOSA: with the speed, the position and the state of the traffic lights.

Figure 51: In-Vehicle Signage: VMS

Description of the use case "in vehicle-signage: 30 zone" and its functioning: Warns the driver if he exceeds the speed limit while in a 30km/h zone in the vicinity of a school area. The data is recovered from the Open Data of the Metropole of Bordeaux.

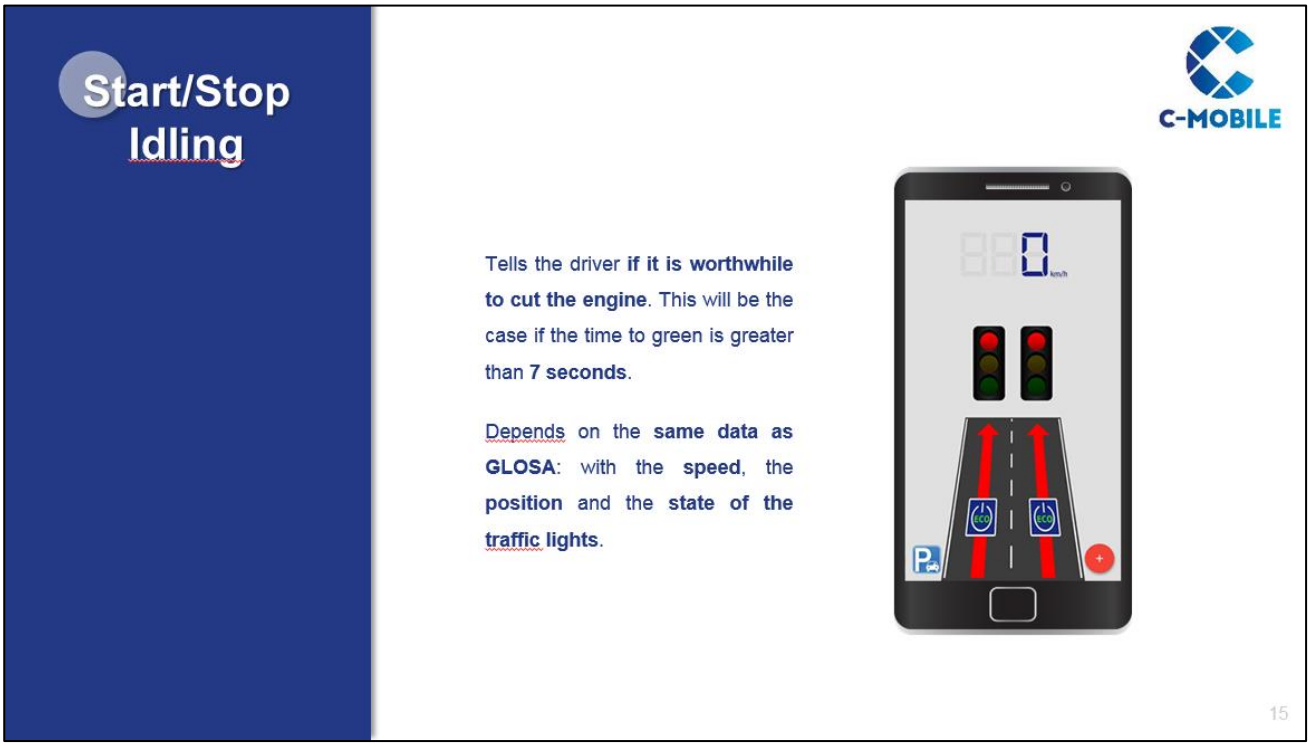


Figure 52: Start/Stop Idling

Description of the use case "in vehicle-signage: variable message signs" and its functioning: notifies the user with variable message signs which are duplication of the physical VMS, or which are virtual and created in a Traffic Management Centre. Create eVMS (embedded VMS) messages that are broadcasted by Central ITS station and RSU.

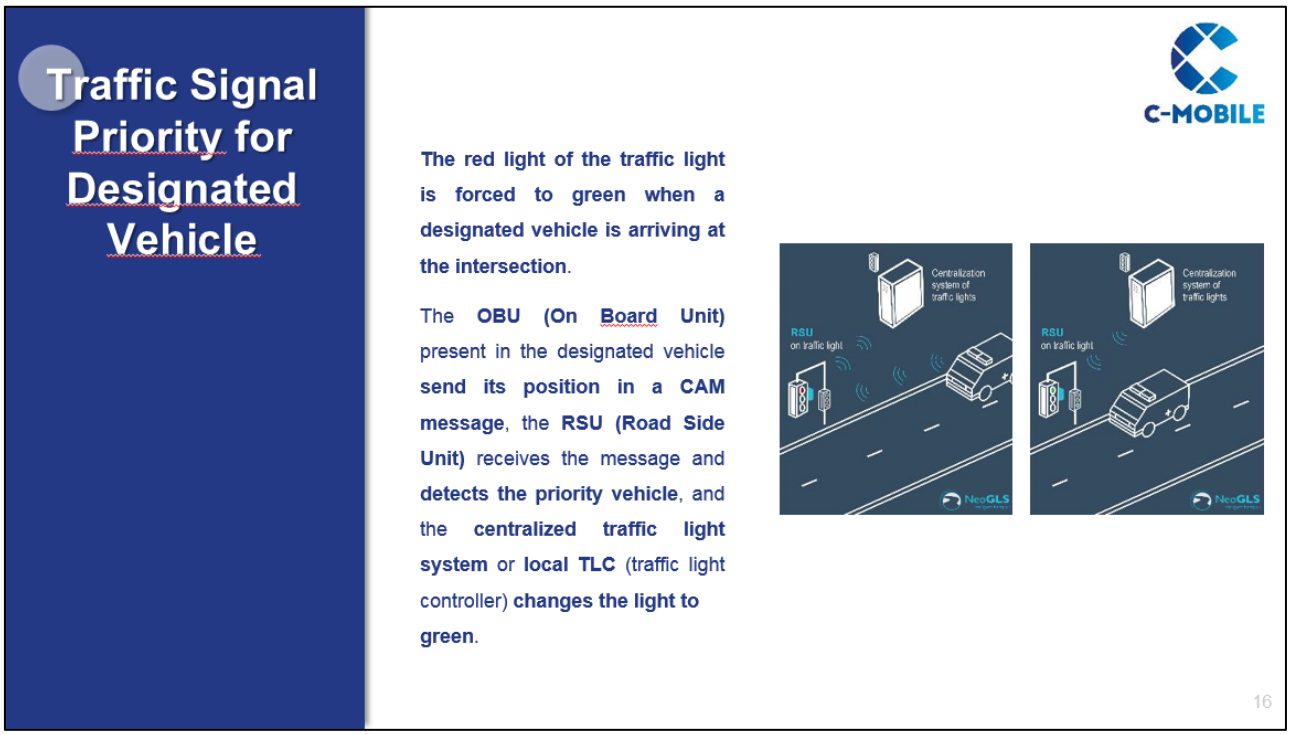


Figure 53: Traffic Signal Priority for Designated Vehicle

Description of the use case “start/stop idling” and its functioning: Tells the driver if it is worthwhile to cut the engine. This will be the case if the time to green is greater than 7 seconds. Depends on the same data as GLOSA: with the speed, the position and the state of the traffic lights.

Description of the use case “traffic signal priority for designated vehicles” and its functioning: The red light of the traffic light is forced to green when a designated vehicle is arriving at the intersection. The OBU (On Board Unit) present in the designated vehicle send its position in a CAM message, the RSU (Road Side Unit) receives the message and detects the priority vehicle, and the centralized traffic light system or local TLC (traffic light controller) changes the light to green.

6.2.3. Practical module

6.2.3.1. Purpose of the module

The practical session will be a demonstration of the driving aid application showing the different C-ITS use cases developed and deployed in Bordeaux. The driver of the demo car will clearly explain to passengers the use cases they will encounter along the way and answer any questions they may have. This demo as for main objective to show in a practical and effective manner the functioning of the different C-ITS use cases for all road users.

6.2.3.2. Description of covered materials

Before the demo we will give to the participants a short leaflet including a summary of all the C-ITS use cases developed and deployed in Bordeaux and its surroundings. The leaflet will also include the map of the demo trip with all the C-ITS they will encounter along the way.

Once the demo is completed, we will give a short survey to the participants to know what they think about the project, its development and deployment in Bordeaux, the usefulness and relevance of the different C-ITS use cases. In this survey, the participants will be asked to give their own and real opinion.

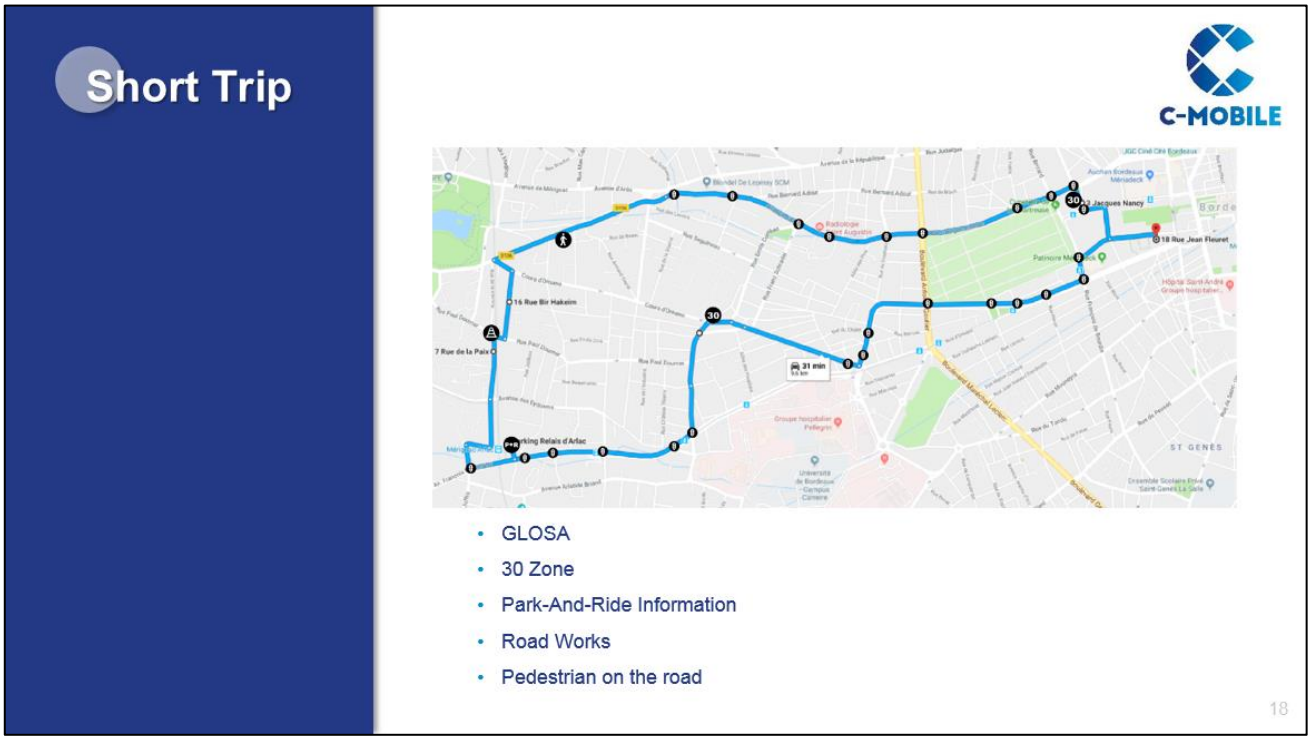


Figure 54: A map of C-ITS services during the demonstration

Showing the trip and the different C-ITS use cases which will be presented: GLOSA, 30 Zone, Park-And-Ride Information, Road Works, Accident, VMS, Pedestrian on the road.

Figure 55: C-ITS services

6.3. Bilbao Deployment Site

6.3.1. Description of Bilbao training

CEIT as organizer, CTVi and MCL as host and IRU as supporter and leader of the training sessions in every site of the project, organized the training for fleet operators of the Bilbao DS the 7th of June. This event will give a general view of all the services developed in Bilbao DS with special focus on MPA service, which is the Bilbao's service that has been working since March. This training was understood to be needed for showing the final users (fleet operators, parking managers and other professional users) how the MPA service would look like in CTVi right before the large-scale deployment.

6.3.1.1. Purpose of the training

Bilbao DS has been involved in the improvement of the different functionalities of the CTVi parking for some months in order to react to their needs. However, until this moment all the management was done manually and thus, following the criterion of each professional. After 3 months of testing, we consider that this training it is a good opportunity to present all the advances to all the parking personnel, the habitual fleet operators and truck drivers that would be the end users of this service. Additionally, this training would be also a tool to increase the awareness of the C-ITS technologies and its benefits to other possible attendees (local partners, associated partners and public authorities) and also the trainers.

6.3.1.2. Participants of the training

Within Task 4.1, a set of training sessions were planned in every region targeting professional drivers. Since Bilbao DS's first training session is focussed on MPA the main target is fleet operators, therefore the training session was organized thinking of fleet operators but also truck drivers and parking management personnel.

6.3.2. Deployment site C-ITS services module

6.3.2.1. Purpose of the module

This session pretends to give an overview of the C-MobILE services available in the Bilbao DS. It is especially important as it is planned to organise further sessions once the rest of the services are ready. This will be an overall showcase and, considering that the sessions are conducted in Spanish language and most of the terms and words from C-MobILE are in English, this session takes especial relevance.

It is not intended that users know all services' names and what they can bring to them, but they should remember the type of information they are going to enjoy while driving/riding with the Bilbao's C-MobILE application.

On the other hand, the objective of this training is also the demonstration of the MPA service implemented in CTVi (Vitoria-Gasteiz) in order to get all the end-users involved for the large scale demonstration.

6.3.2.2. Description of covered materials

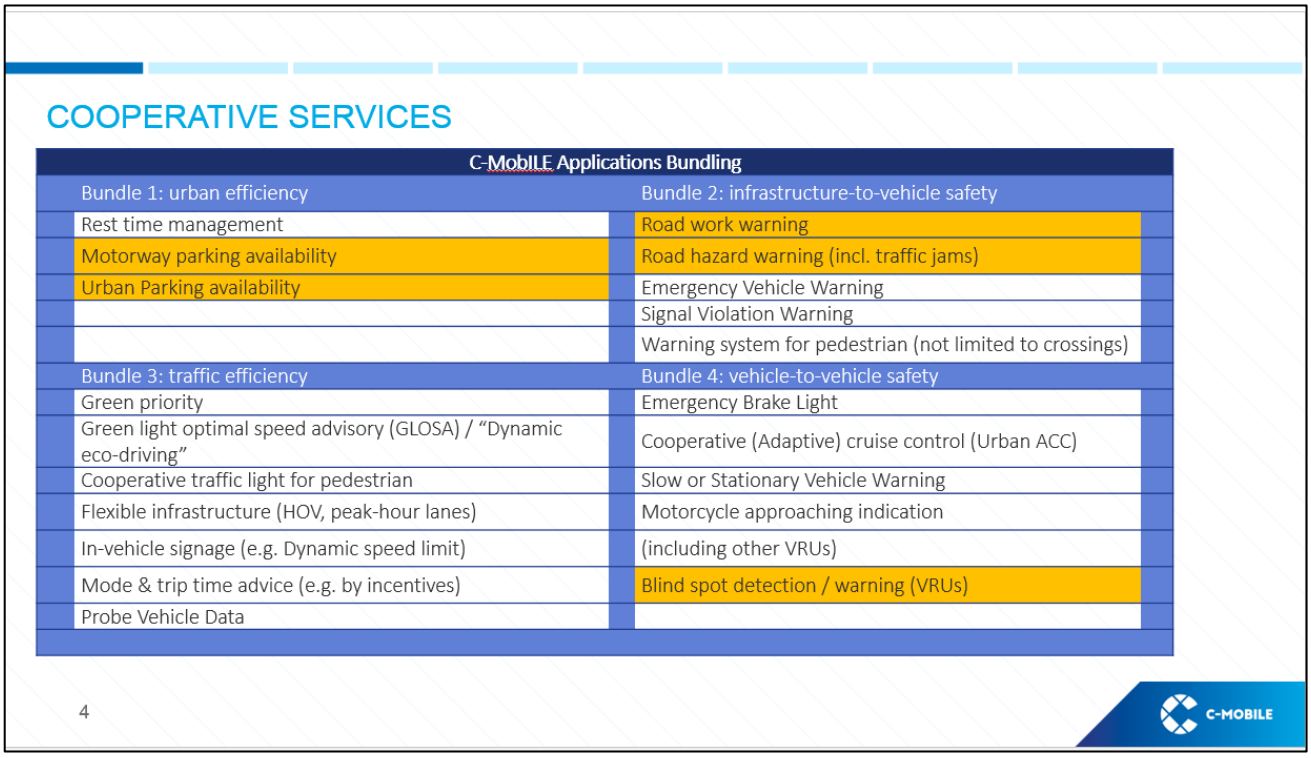


Figure 56: Presentation of C-ITS service deployed in CTVi

This part will consist of an overall presentation of the services that are being deployed in Bilbao and their status. Then it will be a specific introduction of the MPA service and its main objectives due to the demonstration that is programmed later on. Accordingly, it will be a presentation of CTVi parking, how this MPA service is implemented and the new installations. A real-time demonstration of the different tools, (1) the parking management web tool for managers, fleet operators and cabin control personnel as well as (2) the MPA app for truck drivers. Finally, this training will show the benefits of this MPA service and, additionally, the parking managers and other users that were involved in the testing since March may provide their feedback to the attendees.

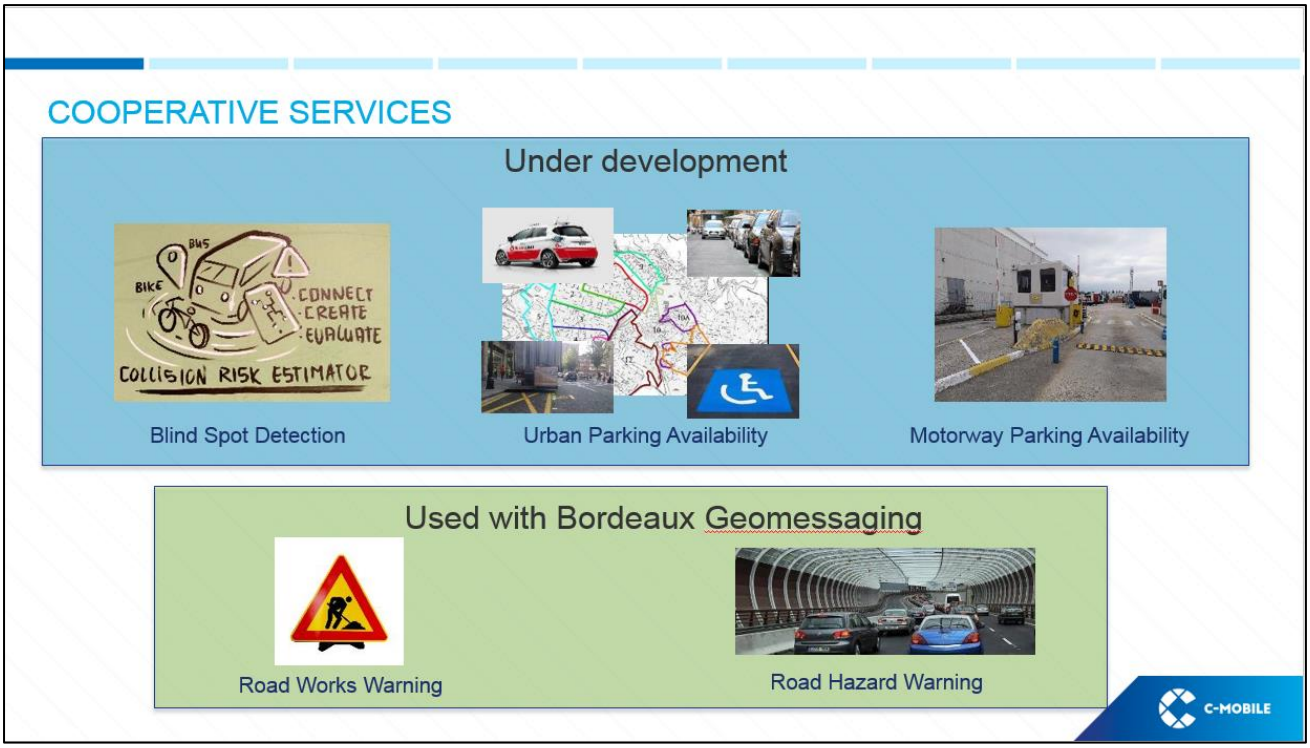


Figure 57: Cooperative services in Bilbao

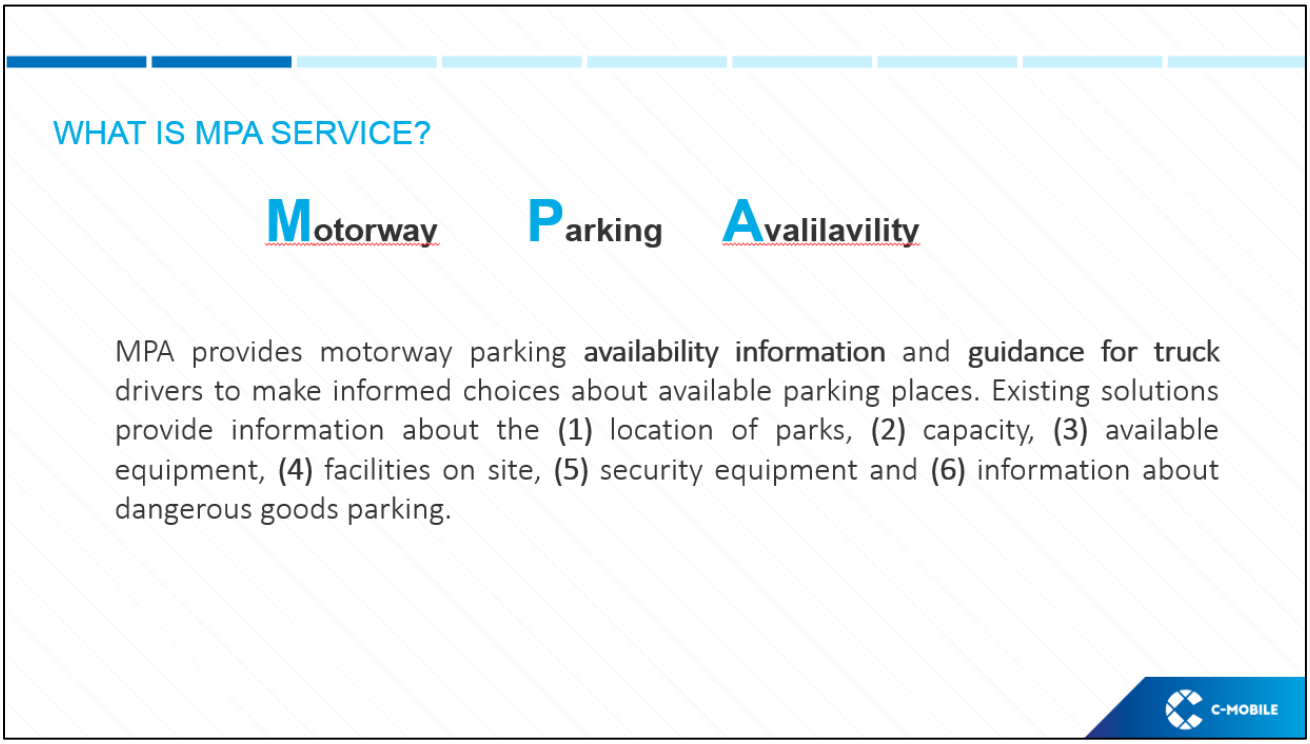


Figure 58: What is MPA service?

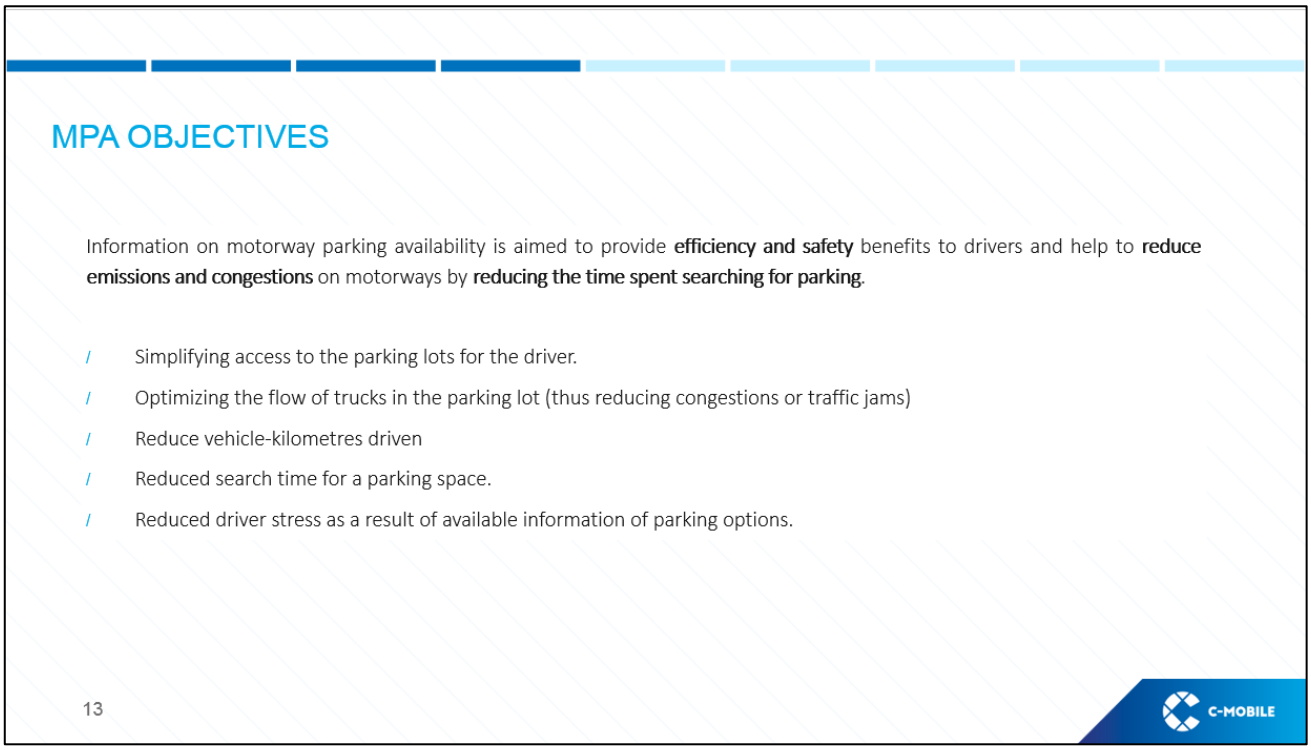


Figure 59: MPA objectives

CHARACTERISTICS

- 180 slots
- Parking secured 24h
- Services and showers
- Restaurant in the vicinities
- No noises
- Taxaction
  - Client with reservation
  - Fleet excess
  - Ocasional
- On weekdays 50% of occupancy
- Manual access management

C-MOBILE

Figure 60: CTVi presentation

USUAL OPERATION AND NEEDS

- Companies that leave the trailer and return to pick it up
  - It requires security. Being a manual management, it implies time
  - Companies send an Excel with the tractors (license plates, name, DNIs, etc.)
  - Sometimes it is not updated. They send a email at the last minute
- The access control is manual
  - The occupation of the parking is determined by the entries/exits registry
  - Occupation review is done by the guard at the shift changes
- Main needs
  - Increase the security of trailer removal and facilitate its management
  - Facilitate the determination of parking occupancy
  - Increase the occupation on weekdays

C-MOBILE

Figure 61: CTVi presentation

C-MOBILE

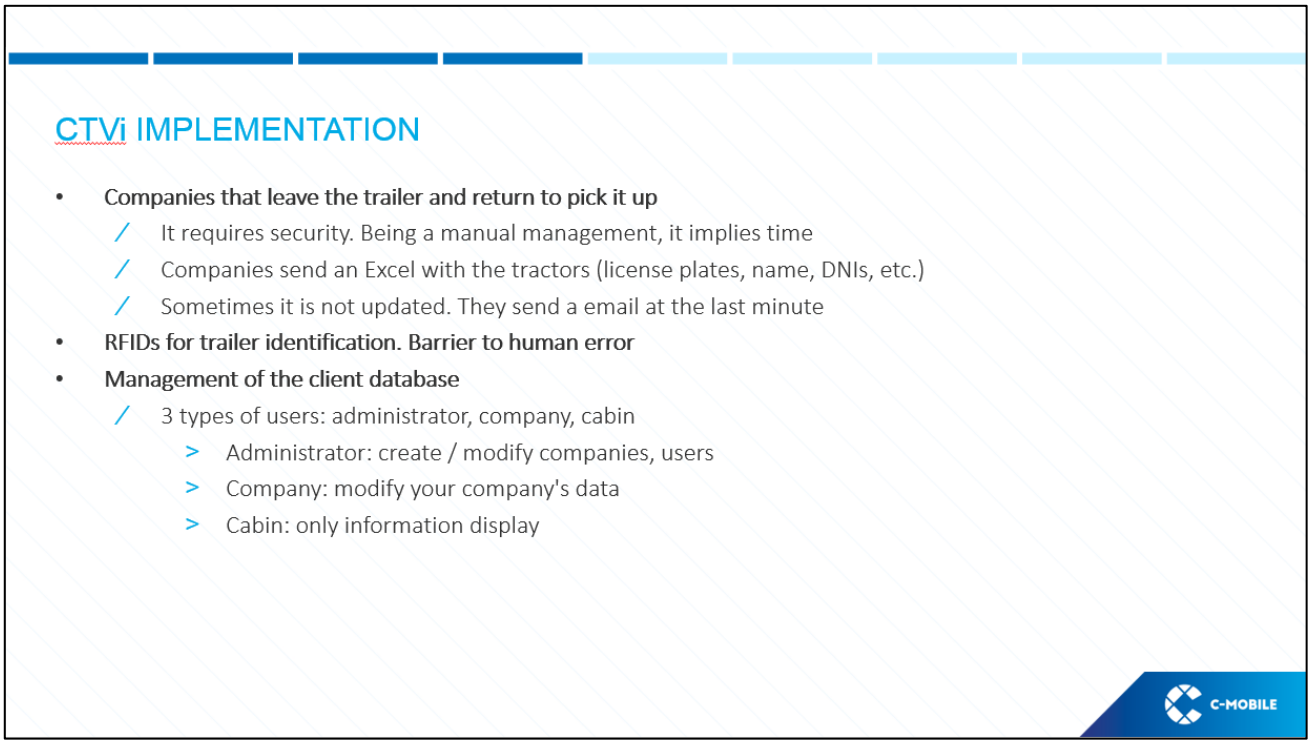


Figure 62: MPA objectives and CTVi implementation

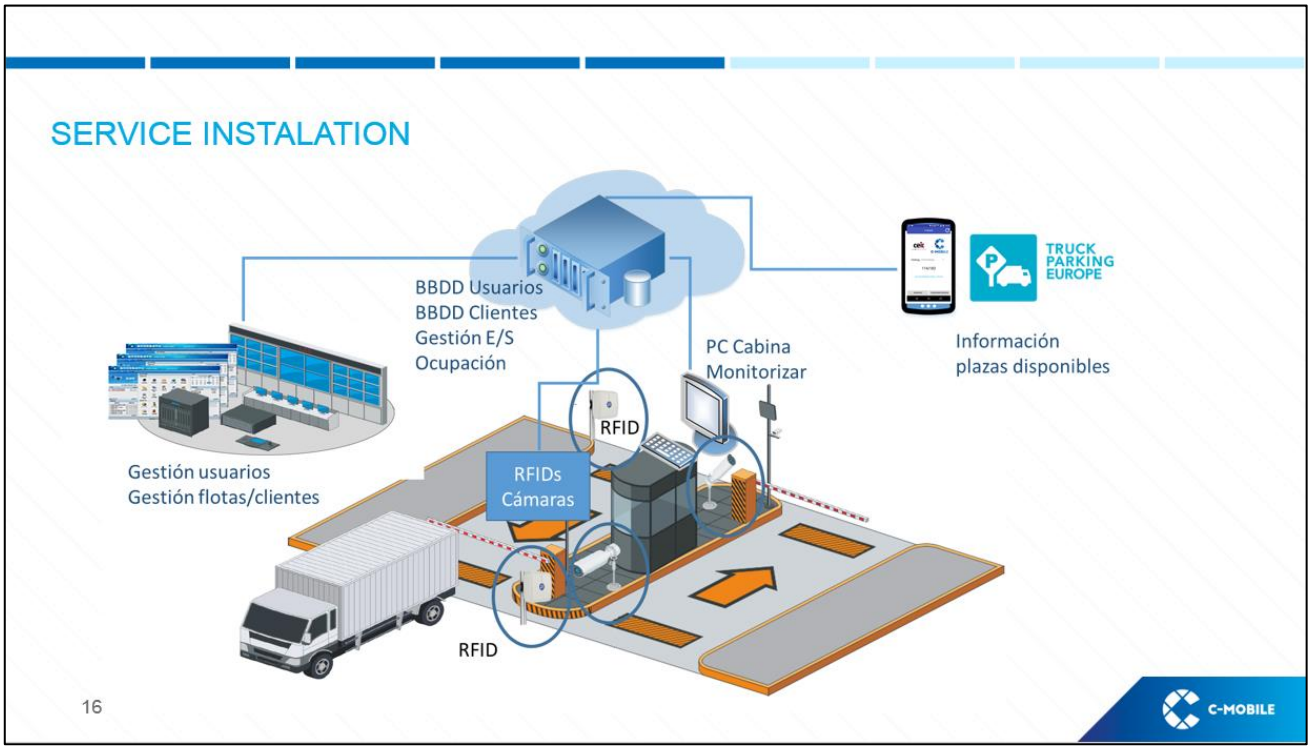


Figure 63: Service installation

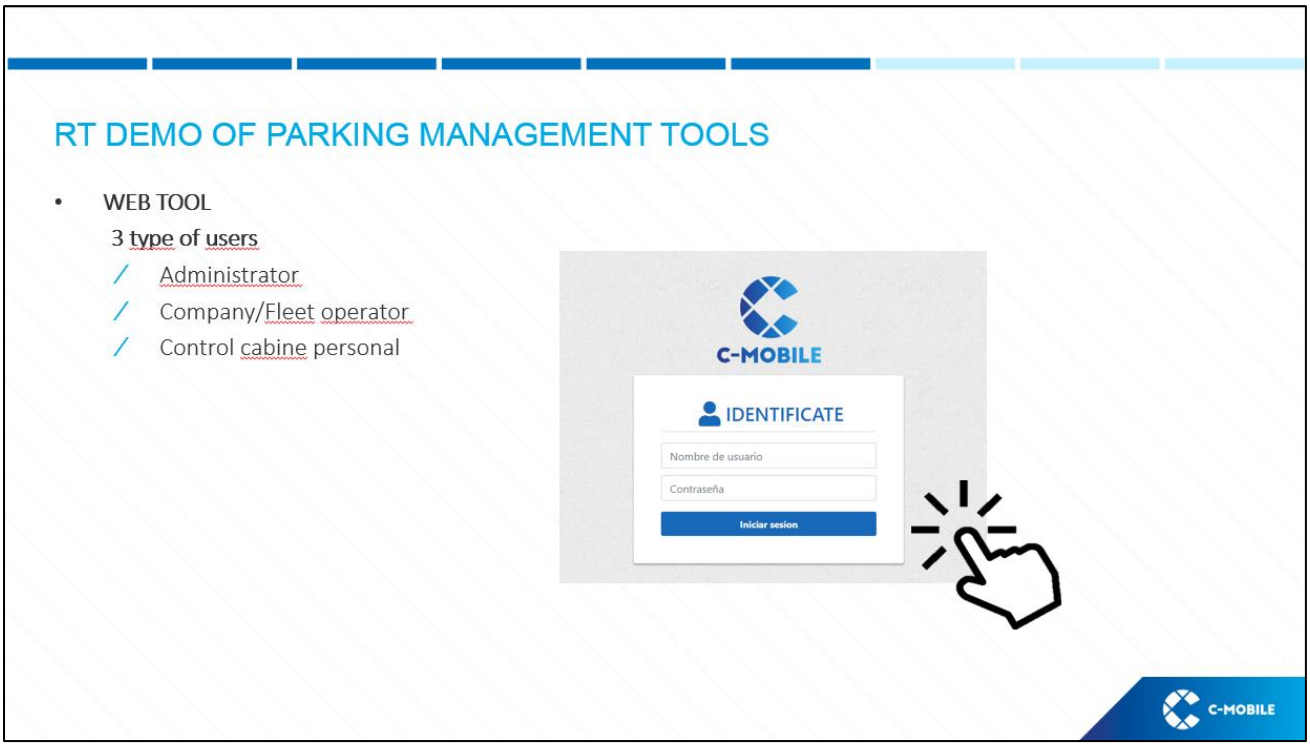


Figure 64: RT demonstration of the parking management tools

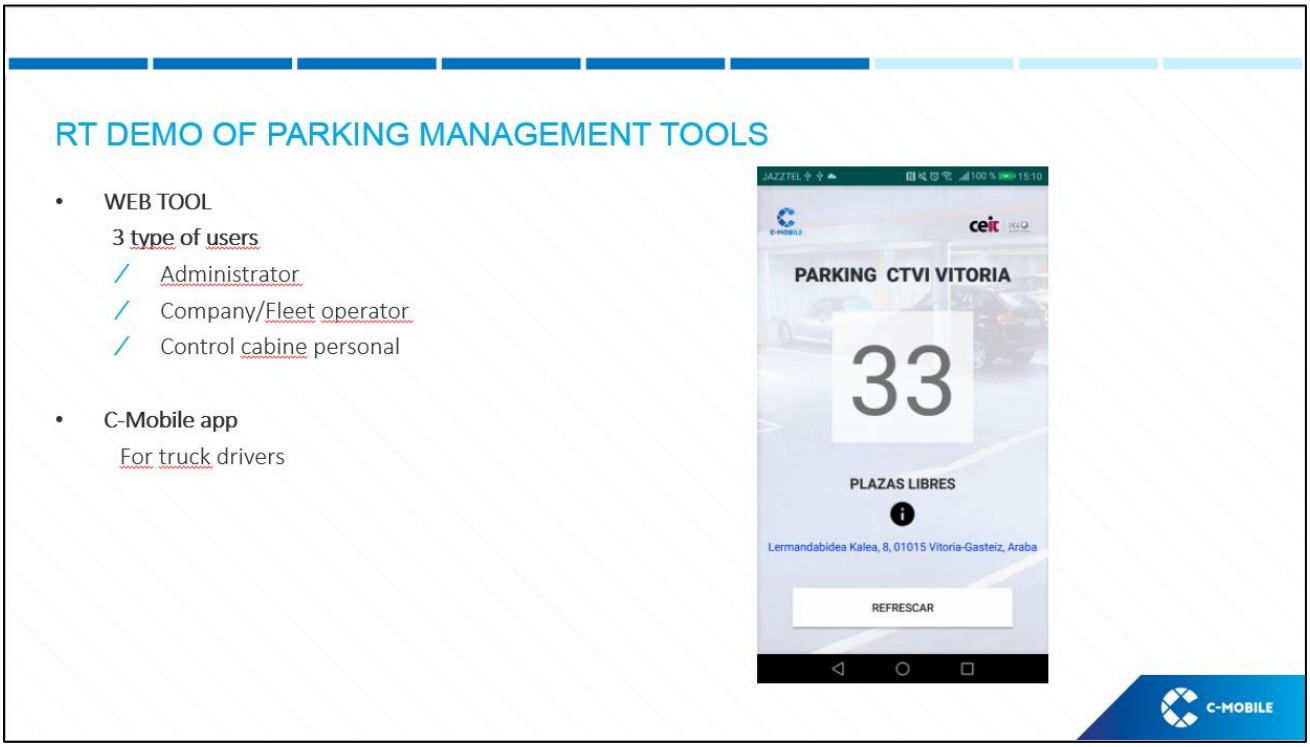


Figure 65: RT demonstration of the parking management tools

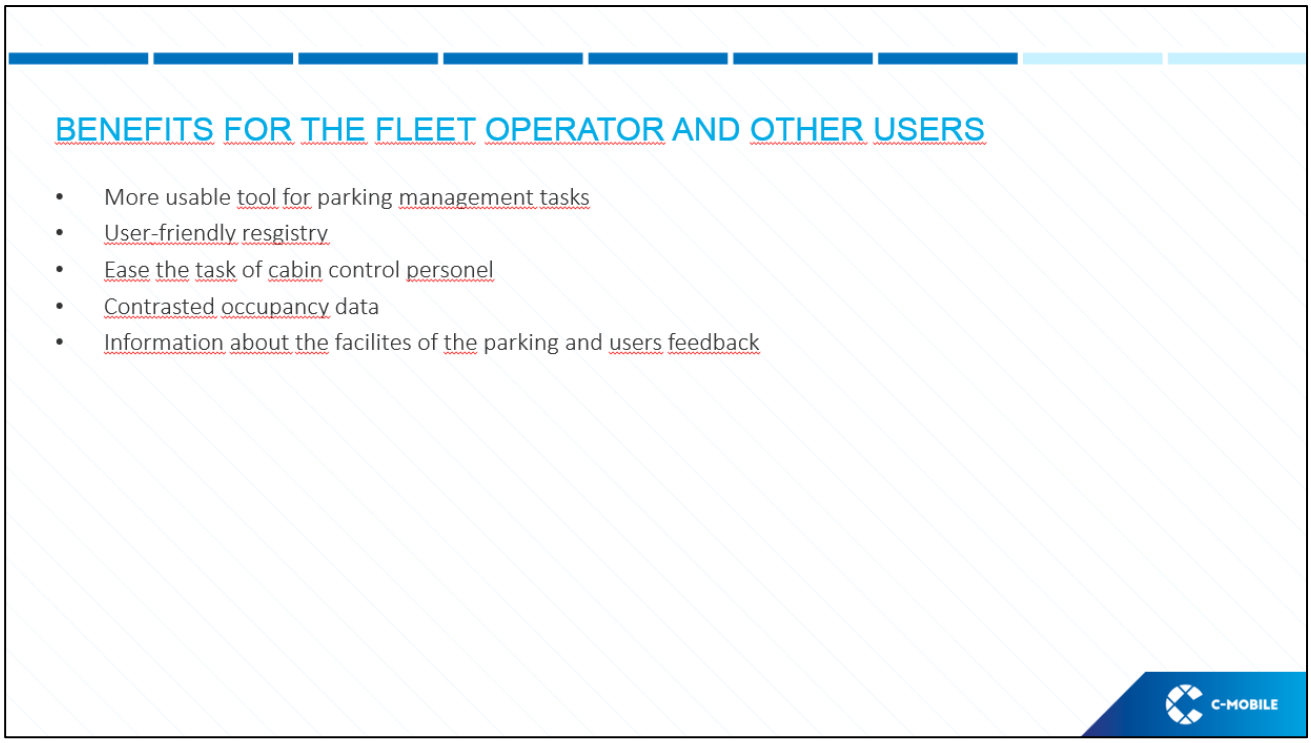


Figure 66: Benefits for the fleet operator and other users

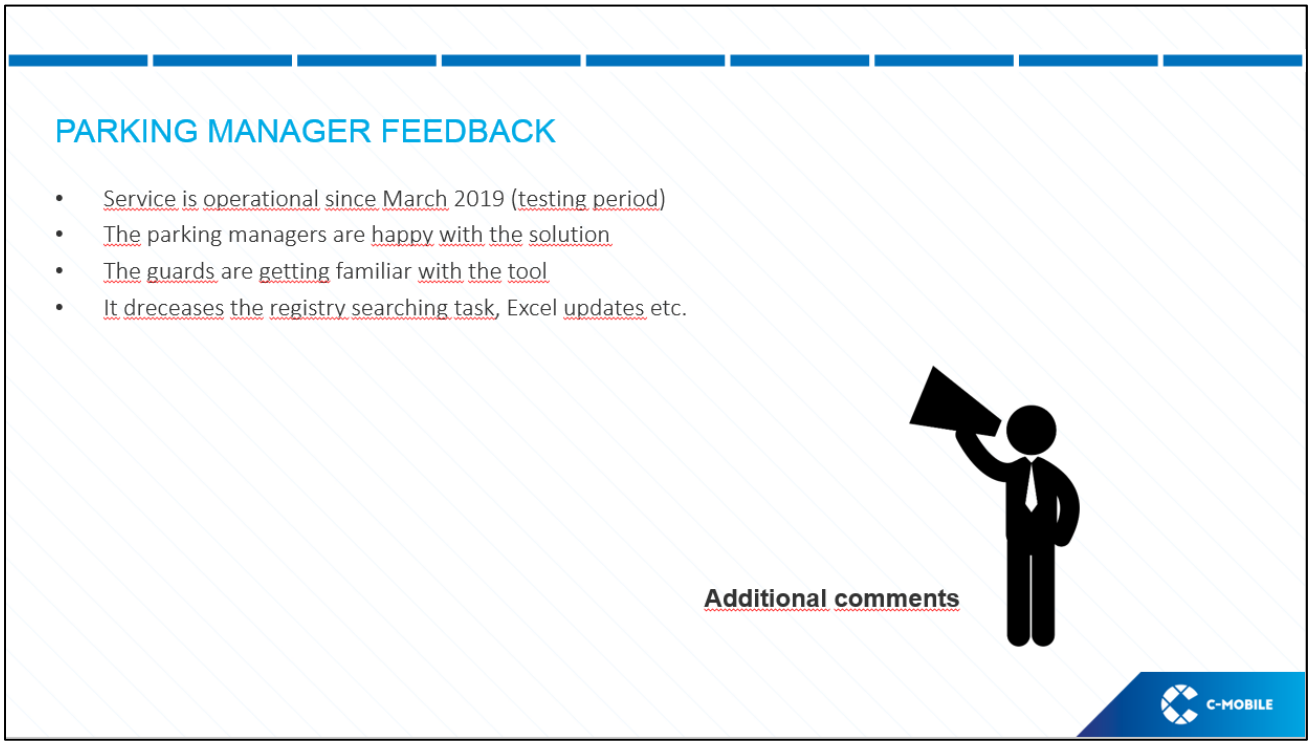


Figure 67: Truck parking Europe

Figure 68: Parking Manager feedback

6.3.3. Practical module

6.3.3.1. Purpose of the module

In this practical session, CEIT will show the MPA service live at the CTVi facilities. The idea is to show that the overall system is already operational in order to encourage all the attendees to participate in the large scale development in the future.

For this aim, all the attendees could download the app and check in real time the availability of the parking. At the same time, a short demonstration will be done also in the cabin control in order to show the procedure on the web tool.

6.3.3.2. Description of covered materials

For the demo the materials will be the C-Mobile MPA app and the web tool developed in Bilbao DS.

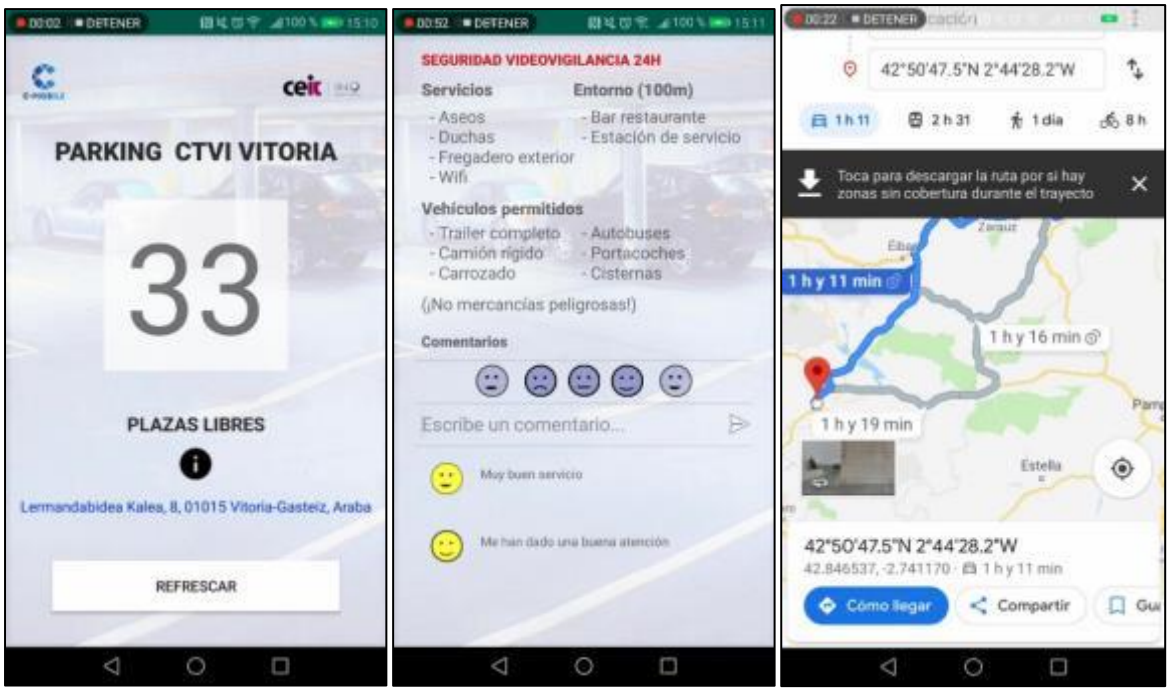


Figure 69: MPA app for truck drivers developed in Bilbao.

Figure 70: Parking management web tool for fleet operators and parking personnel

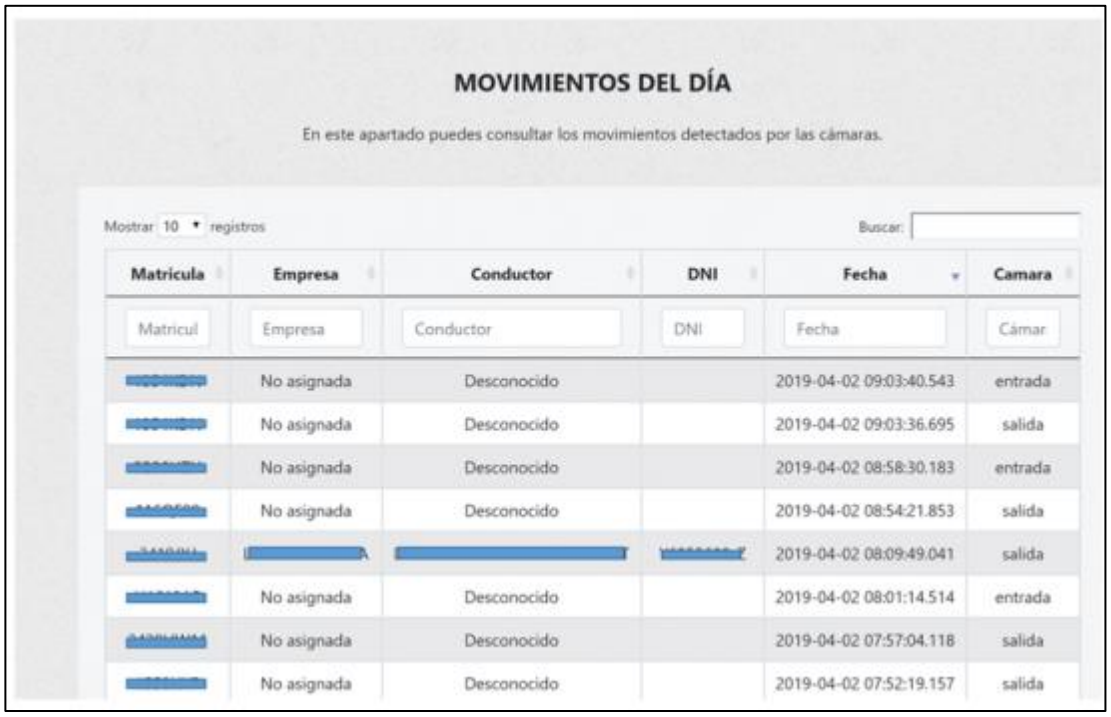


Figure 71: Parking management web tool for fleet operators and parking personnel

6.4. Copenhagen Deployment Site

6.4.1. Description of Copenhagen training

The City of Copenhagen as host and IRU as leader of the training sessions will deliver this event. The event was intended to inform and educate fleet operators, company owners, heads of operations etc. from different big companies about the new C-ITS services deployed in Copenhagen. Furthermore, the training was a means of recruiting companies as partners for the C-MobILE project in Copenhagen in such a way that their drivers would later become end users of the system.

6.4.1.1. Purpose of the training

The purpose of organising the training was twofold. First, to inform companies about the C-ITS solutions about to be deployed in Copenhagen, and ITS & C-ITS solutions in general. The more fundamental knowledge and definitions concerning ITS and C-ITS was prepared by IRU, whereas the presentations about the C-ITS services to be deployed was prepared by the City of Copenhagen. Secondly, in the planning of the Training Event and the publicity about this there was an emphasis on the possibility for the companies to participate in the large-scale deployment and borrow OBU equipment for a period of 1 to 1½ years while the large scale demonstration was being evaluated.

6.4.1.2. Participants of the training

The training was organised to focus on fleet operators and higher-level personnel of big transport and logistics companies operating in Copenhagen.

6.4.2. Deployment site C-ITS services module

6.4.2.1. Purpose of the module

This module was meant as a presentation of the C-MobILE services that will be available in Copenhagen and which impact on driving we expect them to have.

6.4.2.2. Description of covered materials

The structure of the presentation was to give the participants an introduction to the political framework and goals by the City of Copenhagen in relation to motorized vehicles, logistics and transport companies. Then to present the services provided through the C-MobILE project.

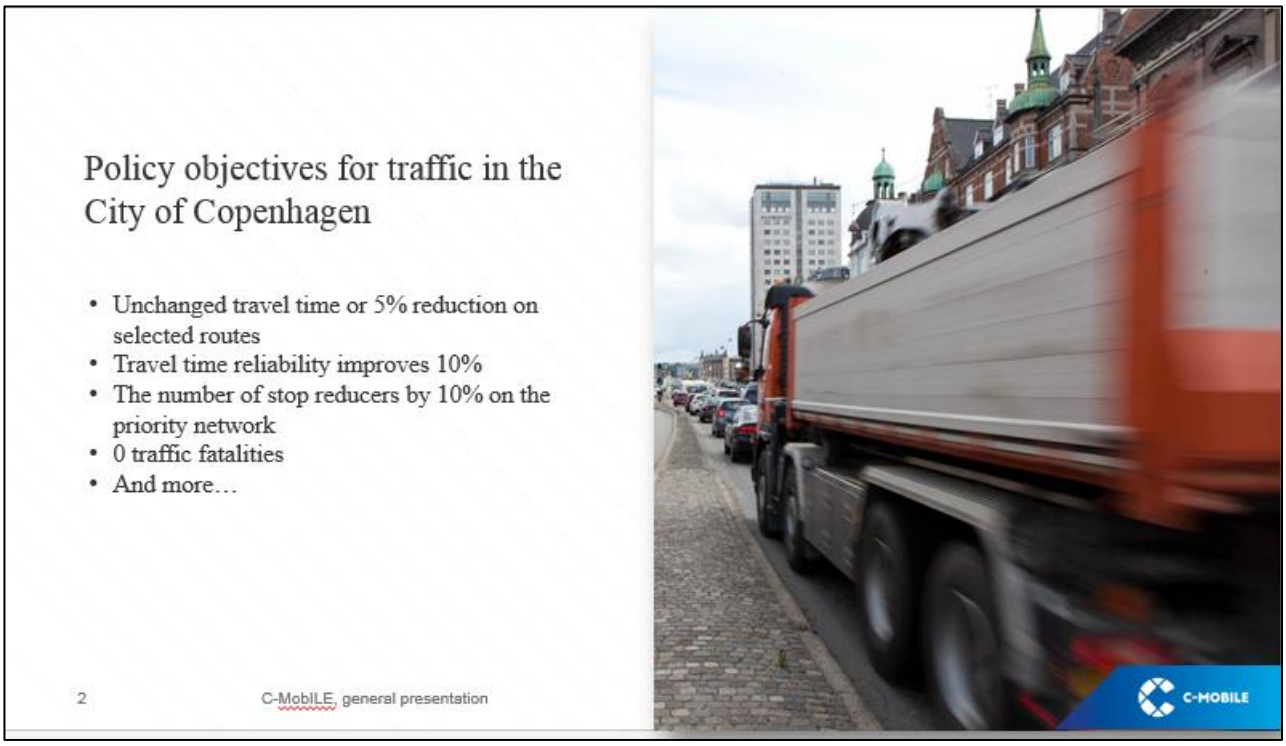


Figure 72: Policy Objectives

Political goals for motorised transport: 5% reduction on certain corridors, 10% increase in travel time reliability, 10% reduction in number of stops, 0 deadly accidents.

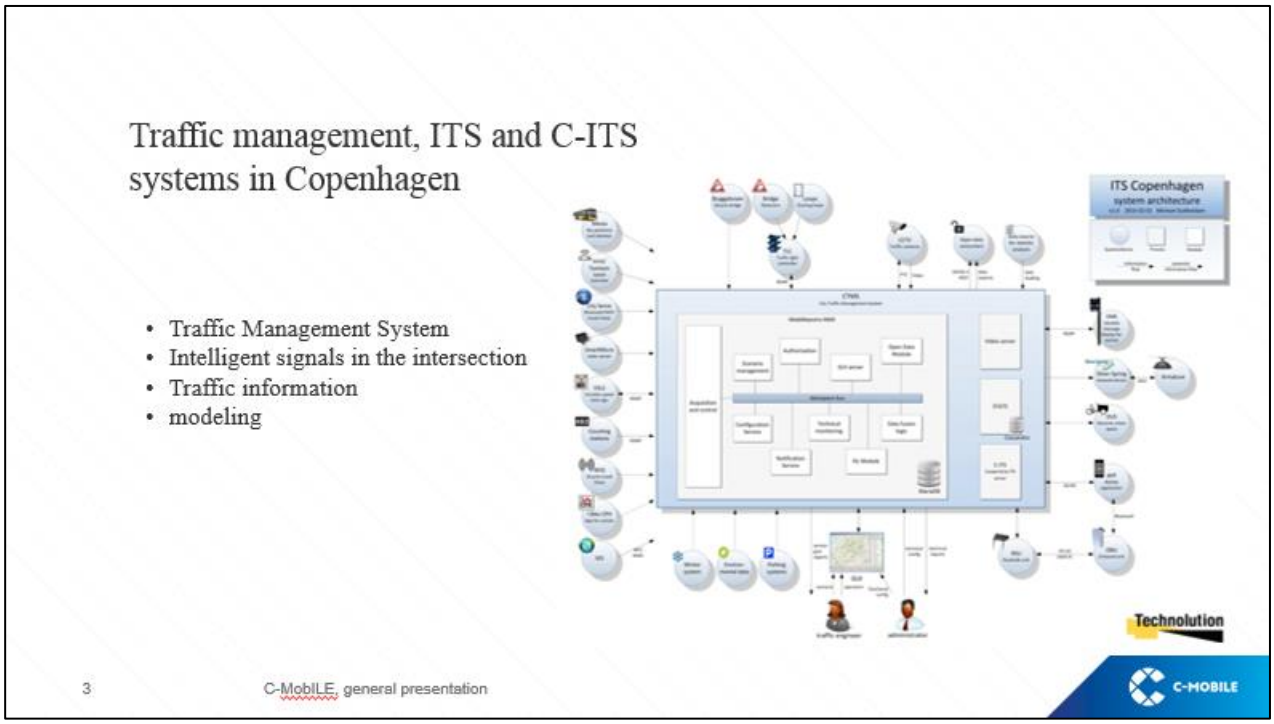


Figure 73: Traffic management, ITS and C-ITS in Copenhagen

Figure 74: Overview of C-ITS services deployed in Copenhagen

Figure 75: GLOSA service

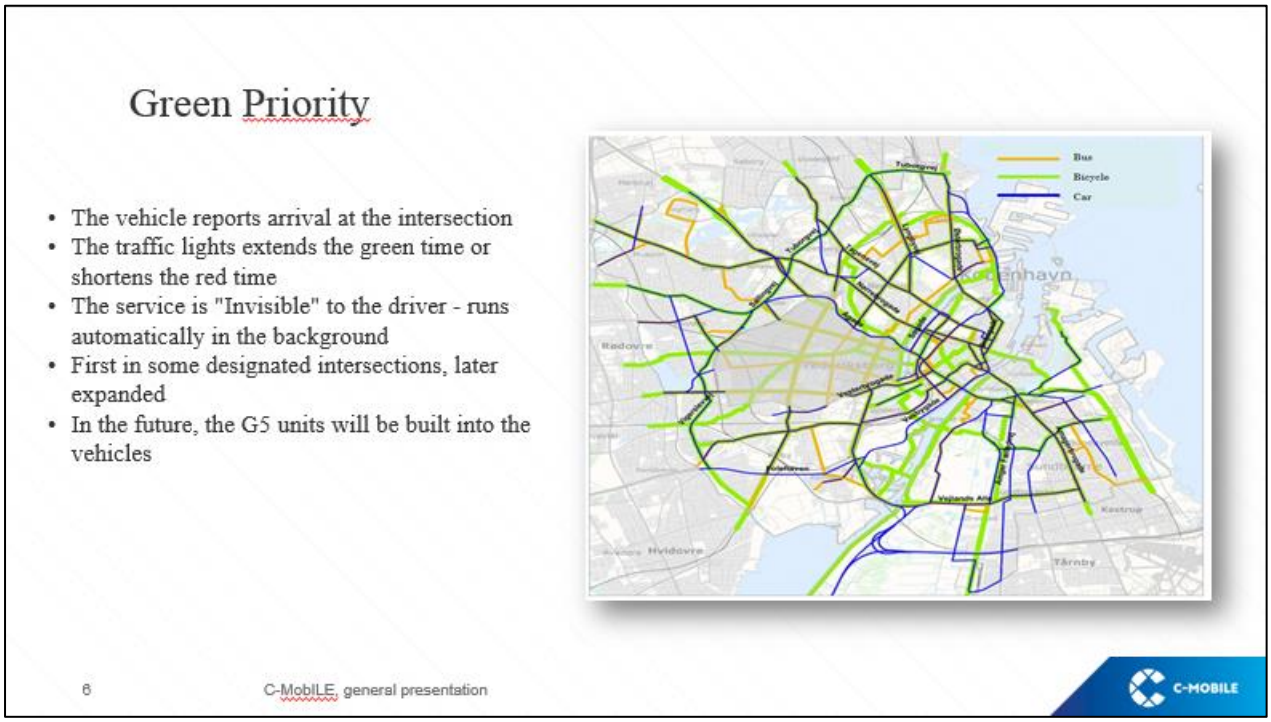


Figure 76: Green Priority explanation

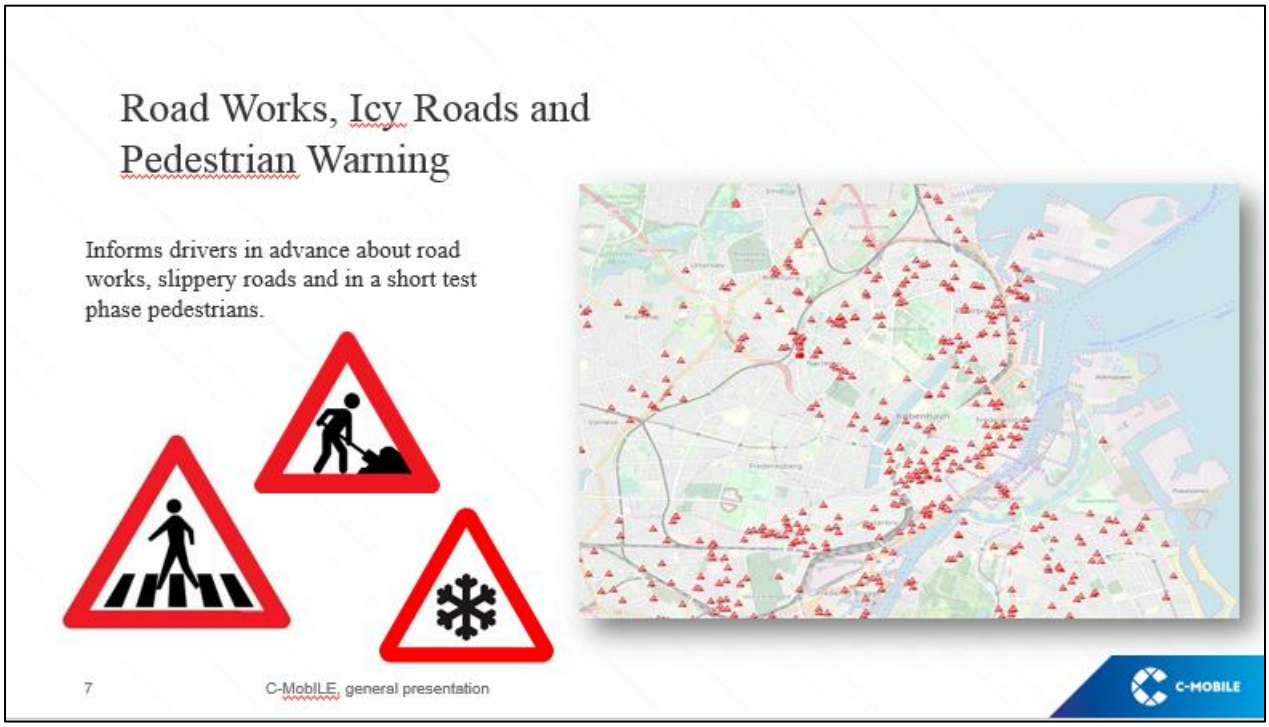


Figure 77: Road works, pedestrian and road hazard warning

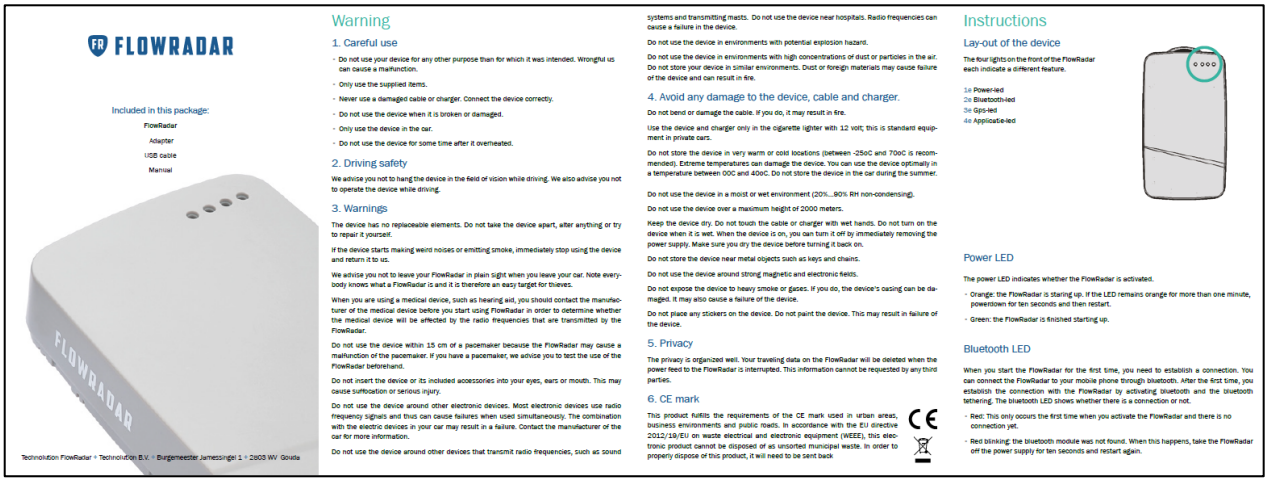
6.4.3. Practical module

6.4.3.1. Purpose of the module

As the development of the system is not yet fully finalised there was not practical module as such. Instead we planned a Q&A and some time for feedback from the companies on whether the services presented were interesting. Furthermore, there was an opportunity to sign up for lending the OBU equipment for a period and try out the services.

6.4.3.2. Description of covered materials

A brochure on the installation and operation of the OBU and GreenCatch app would be provided.



FLOWRADAR

Included in this package:

FlowRadar
Adapter
USB cable
Manual

Technolution FlowRadar ▪ Technolution B.V. ▪ Burgemeester Jamessingel 1 ▪ 2803 WV Gouda

Warning

1. Careful use

- Do not use your device for any other purpose than for which it was intended. Wrongful us can cause a malfunction.
- Only use the supplied items.
- Never use a damaged cable or charger. Connect the device correctly.
- Do not use the device when it is broken or damaged.
- Only use the device in the car.
- Do not use the device for some time after it overheated.

2. Driving safety

We advise you not to hang the device in the field of vision while driving. We also advise you not to operate the device while driving.

3. Warnings

The device has no replaceable elements. Do not take the device apart, alter anything or try to repair it yourself.

If the device starts making weird noises or emitting smoke, immediately stop using the device and return it to us.

We advise you not to leave your FlowRadar in plain sight when you leave your car. Note everybody knows what a FlowRadar is and it is therefore an easy target for thieves.

When you are using a medical device, such as hearing aid, you should contact the manufacturer of the medical device before you start using FlowRadar in order to determine whether the medical device will be affected by the radio frequencies that are transmitted by the FlowRadar.

Do not use the device within 15 cm of a pacemaker because the FlowRadar may cause a malfunction of the pacemaker. If you have a pacemaker, we advise you to test the use of the FlowRadar beforehand.

Do not insert the device or its included accessories into your eyes, ears or mouth. This may cause suffocation or serious injury.

Do not use the device around other electronic devices. Most electronic devices use radio frequency signals and thus can cause failures when used simultaneously. The combination with the electric devices in your car may result in a failure. Contact the manufacturer of the car for more information.

Do not use the device around other devices that transmit radio frequencies, such as sound systems and transmitting masts. Do not use the device near hospitals. Radio frequencies can cause a failure in the device.

Do not use the device in environments with potential explosion hazard.

Do not use the device in environments with high concentrations of dust or particles in the air. Do not store your device in similar environments. Dust or foreign materials may cause failure of the device and can result in fire.

4. Avoid any damage to the device, cable and charger.

Do not bend or damage the cable. If you do, it may result in fire.

Use the device and charger only in the cigarette lighter with 12 volt; this is standard equipment in private cars.

Do not store the device in very warm or cold locations (between -250C and 700C is recommended). Extreme temperatures can damage the device. You can use the device optimally in a temperature between 00C and 400C. Do not store the device in the car during the summer.

Do not use the device in a moist or wet environment (20%...90% RH non-condensing).

Do not use the device over a maximum height of 2000 meters.

Keep the device dry. Do not touch the cable or charger with wet hands. Do not turn on the device when it is wet. When the device is on, you can turn it off by immediately removing the power supply. Make sure you dry the device before turning it back on.

Do not store the device near metal objects such as keys and chains.

Do not use the device around strong magnetic and electronic fields.

Do not expose the device to heavy smoke or gases. If you do, the device's casing can be damaged. It may also cause a failure of the device.

Do not place any stickers on the device. Do not paint the device. This may result in failure of the device.

5. Privacy

The privacy is organized well. Your traveling data on the FlowRadar will be deleted when the power feed to the FlowRadar is interrupted. This information cannot be requested by any third parties.

6. CE mark

This product fulfills the requirements of the CE mark used in urban areas, business environments and public roads. In accordance with the EU directive 2012/19/EU on waste electrical and electronic equipment (WEEE), this electronic product cannot be disposed of as unsorted municipal waste. In order to properly dispose of this product, it will need to be sent back

Instructions

Lay-out of the device

The four lights on the front of the FlowRadar each indicate a different feature.

1e Power-led
2e Bluetooth-led
3e Gps-led
4e Applicatie-led

Power LED

The power LED indicates whether the FlowRadar is activated.

- Orange: the FlowRadar is staring up. If the LED remains orange for more than one minute, powerdown for ten seconds and then restart.
- Green: the FlowRadar is finished starting up.

Bluetooth LED

When you start the FlowRadar for the first time, you need to establish a connection. You can connect the FlowRadar to your mobile phone through bluetooth. After the first time, you establish the connection with the FlowRadar by activating bluetooth and the bluetooth tethering. The bluetooth LED shows whether there is a connection or not.

- Red: This only occurs the first time when you activate the FlowRadar and there is no connection yet.
- Red blinking: the bluetooth module was not found. When this happens, take the FlowRadar off the power supply for ten seconds and restart again.

Figure 78: Manual for installation of OBU/FlowRadar

- Orange: the FlowRadar cannot connect to the bluetooth of your mobile phone. Check whether your bluetooth is activated. If the bluetooth is activated, deactivate and reactivate the bluetooth.
- Orange blinking: the FlowRadar is visible on your mobile phone; you can start connecting.
- Green blinking: the FlowRadar is connected via bluetooth and the tethering is active. There is a connection between your mobile phone and FlowRadar.

GPS LED

The GPS LED indicates whether the FlowRadar has a (strong) GPS connection or not.

- Red: no GPS signal. Try to park the car outdoors and not, for example, in a garage. The FlowRadar picks up the signal better when it is near a window.
- Red blinking: the GPS module was not found. When this happens, take the FlowRadar off the power supply for ten seconds and restart again.
- Orange: please wait. When the LED is orange for longer than one minute, take the FlowRadar off the power supply for ten seconds and restart again.
- Green: the GPS is activated.
- Green blinking: GPS is working and has good reception.

Application LED

The application LED indicates whether the three other elements (power, bluetooth and GPS) are working.

- Red: there is a problem with one of the other elements. Check to see what other LED indicates a problem. If only the application LED lights up, take the FlowRadar off the power supply for ten seconds and restart again.
- Red blinking: no connection to the roadside. You can take the FlowRadar off the power supply for ten seconds.
- Green: the FlowRadar is working correctly.

Installation in the car

Step 1
Tighten the suction cup on the back to the FlowRadar (see image 1).

Step 2
The FlowRadar is to be placed in the lower right corner of the windscreen. It is crucial to be able to correctly adjust the antennas of the FlowRadar to the roadside. And this way, you will keep the best view during driving.

Step 3
The FlowRadar should be connected using the included cable and charger. You insert the micro USB in the FlowRadar (see image 2) and the USB in the charger for the cigarette lighter. The adapter has two USB ports. The FlowRadar needs to be inserted in the USB port with 2.1 ampere. In the other port (1.1 ampere) you can connect your mobile phone. You can then place the charger in the cigarette lighter. As soon as the FlowRadar has a power supply, it will automatically start up. On the FlowRadar, the leftmost light will light up orange. When FlowRadar is finished starting up, the light will turn green.

Connecting phone

Step 1
The FlowRadar has to be started up. This will happen automatically when you connect the FlowRadar to a power source. (See installation in the car).

Step 2
In order to connect the FlowRadar to your mobile phone, you need to activate the bluetooth. Because each Android version has different settings and functions that are operated in a different manner, you can find an explanation for the most commonly used version below. You can see in your settings and device information which Android version you are using. In all iOS versions from 7.0, the settings can be found in the same way.

Android 5.1.1 and 4.2.2: Go to 'Settings' and then to 'Wireless and networks' and 'Bluetooth'. Activate the bluetooth.

Android 4.4.2: Go to 'Settings' and then to 'Connections' and 'Bluetooth'. Activate the bluetooth.

Android 4.3: Go to 'Settings' and then to 'Connections' and 'Bluetooth'. Activate the bluetooth.

Android 4.1.2: Go to 'Settings' and then to 'All' and 'Bluetooth'. Activate the bluetooth.

iOS 7 and up: Go to 'Settings' and to 'Bluetooth'. Activate the bluetooth.

Step 3
Then you can share tethering (internet) via bluetooth, also called a 'personal hotspot'.

Android 5.1.1 and 4.2.2: Go to 'Settings' and then to 'Wireless and networks', 'More', 'Tethering and portable hotspot' and 'Bluetooth tethering'. Activate bluetooth tethering.

Android 4.4.2: Go to 'Settings' and then to 'Connections', 'Tethering and WiFi hotspot' and 'Bluetooth tethering'. Activate bluetooth tethering.

Android 4.3: Go to 'Settings' and then to 'Connections', 'More', 'Networks', 'Tethering and portable hotspot' and 'Bluetooth tethering'. Activate bluetooth tethering.

Android 4.1.2: Go to 'Settings' and then to 'All', 'More', 'Tethering and portable hotspot' and 'Bluetooth tethering'. Activate bluetooth tethering.

iOS 7 and higher: Go to 'Settings' and to 'Personal hotspot'. Activate your personal hotspot.

Step 4
The FlowRadar is not immediately detectable for your mobile phone via bluetooth. The FlowRadar must be made detectable first. You can do this by pressing the two outer buttons (the leftmost and rightmost buttons) on the FlowRadar simultaneously for three seconds. The second lamp from the left (bluetooth) will now start blinking orange. The FlowRadar can then be detected by the mobile phone for a period of 2 minutes. (see image 3)

Step 5
Now the FlowRadar can be detected by the mobile phone, you can use the bluetooth to search for the FlowRadar. First go back to the bluetooth configuration (step 2). The mobile phone will automatically search for any available devices. If this is not the case with your mobile phone, choose 'search for devices (bluetooth devices)'. The FlowRadar appears in the screen.

Step 6
Click on the FlowRadar bluetooth device found on your mobile phone. The FlowRadar and the mobile phone are connected. The next time you will be driving and the FlowRadar is activated, it will automatically connect if you have activated bluetooth (step 2) and tethering via bluetooth (step 3).

Step 7
In order to turn off the FlowRadar, you can take it off its power supply. You can simply unplug it from the cigarette lighter. As soon as the FlowRadar is off the power supply, it automatically deletes any data from the last journey and shuts itself off.

Figure 79: Manual for installation of OBU/FlowRadar

CITY OF COPENHAGEN

greencatch

Manual

GreenCatch is the city of Copenhagen's app to help you reach the green light at signalized intersections. Following the GreenCatch speed advices helps you reduce the number of stops, reduce your acceleration and deceleration and experience a smoother flow. In this way, you contribute significantly to reduce the fuel consumption of your vehicle as well as CO2 emissions. However, as a road user, you must at all times obey all instructions on regulatory traffic signs, and drive carefully and attentively. GreenCatch can therefore not be held responsible for any damage, injury and direct or indirect consequence of a correct or incorrect advice.

Figure 80: Front page of the HMI app GreenCatch user manual

6.5. Newcastle Deployment Site

6.5.1. Description of Newcastle training

6.5.1.1. Purpose of the training

There are, broadly, three reasons the training has been organised. Firstly, the training session is designed to act as publicity for the deployment site with a primary focus on the existing stakeholders. Although the bus company is familiar with the project and the deployment, other operators are not. The event provides an opportunity to inform these stakeholders about the C-ITS deployment and its current status and forthcoming milestones, and also about the wider C-MOBILE project.

Secondly, we feel that the training event provides us an opportunity to promote the C-ITS deployment through emphasising the positive benefits of C-ITS to the operators, and hopefully drivers. This is most likely to be successful through such a face to face workshop. The deployment site module will be comprehensive in explaining the underpinning reasons for C-ITS in Newcastle and the services that will be available.

Finally, the concept of training in itself. Although full practical training for drivers will take place internally when the on-board units and HMIs are installed on the vehicles, this event will provide classroom-based familiarisation with the services, the way the system works, and aspects relating to data – in particular it will seek to reassure drivers who are worried about how their driving data is used by the project and their own management.

Due to delays to the deployment and certain logistical challenges a fully operational practical demo on the equipped corridor was not available. However, the practical module demonstrated the technologies used as they affect both the drivers and the traffic management centre, through video clips and a walk-around of an equipped car giving first-hand experience of OBU, HMI, antenna and discussion with technical partners about installation criteria and ergonomic aspects.

6.5.1.2. Participants of the training

Training took place on Friday 14th June 2019.

The target audience was primarily the fleet operators who comprise the main end users in Newcastle. These are:

- Bus operator (Arriva – part of DB group)
- Commercial vehicles
- Taxi operators

These stakeholders have been engaged prior to the event to ascertain particular views on C-ITS and training needs, within the remit of the training programme being organised by IRU. The attendees totalled 16, which included 1 from NCC, 1 from the UTMC, 2 from UNEW, 1 taxi driver/ manager, 3 from industry, and 7 bus drivers and one bus operator.

6.5.2. Deployment site C-ITS services module

6.5.2.1. Purpose of the module

The purpose of the module is:

- To promote and publicise C-ITS in Newcastle
- To provide an initial project-level training and demonstration of selected services
- To promote C-MOBILE
- To answer questions that the users may have about C-ITS and the generated data.

6.5.2.2. Description of covered materials

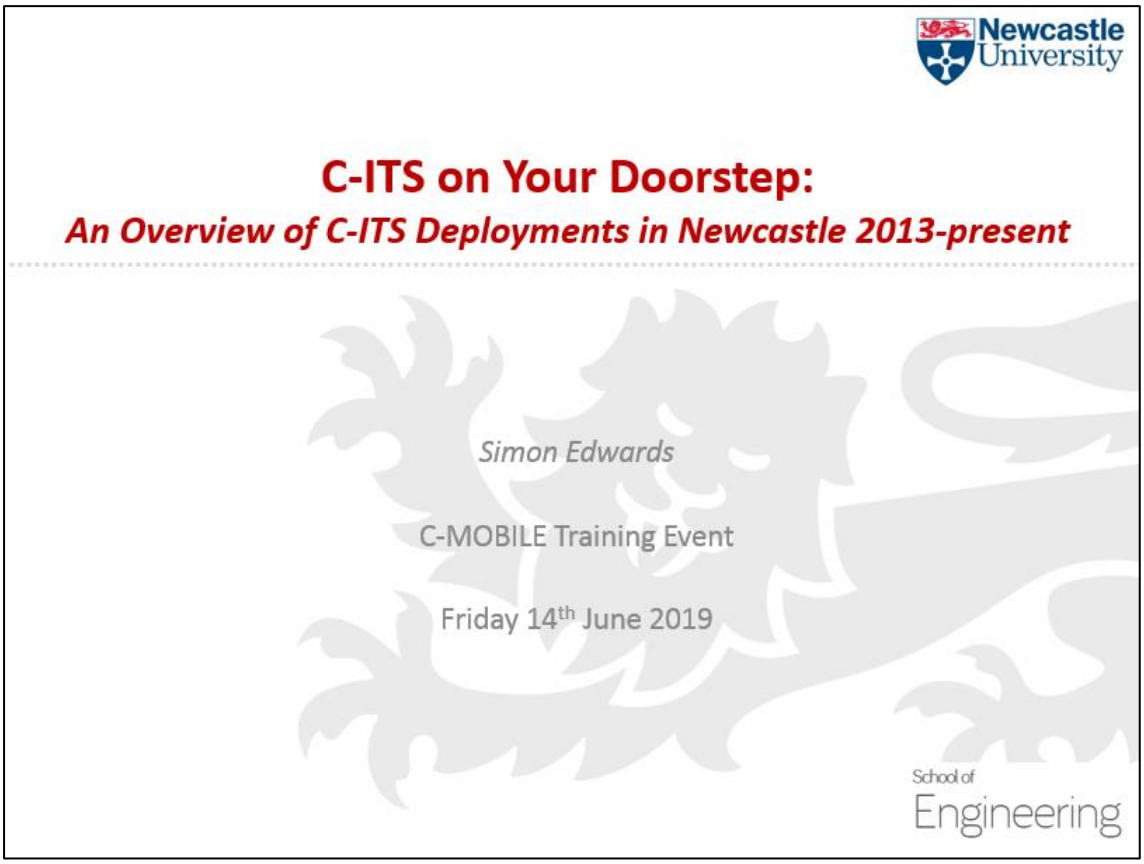


Figure 81: An Overview of C-ITS Deployments in Newcastle

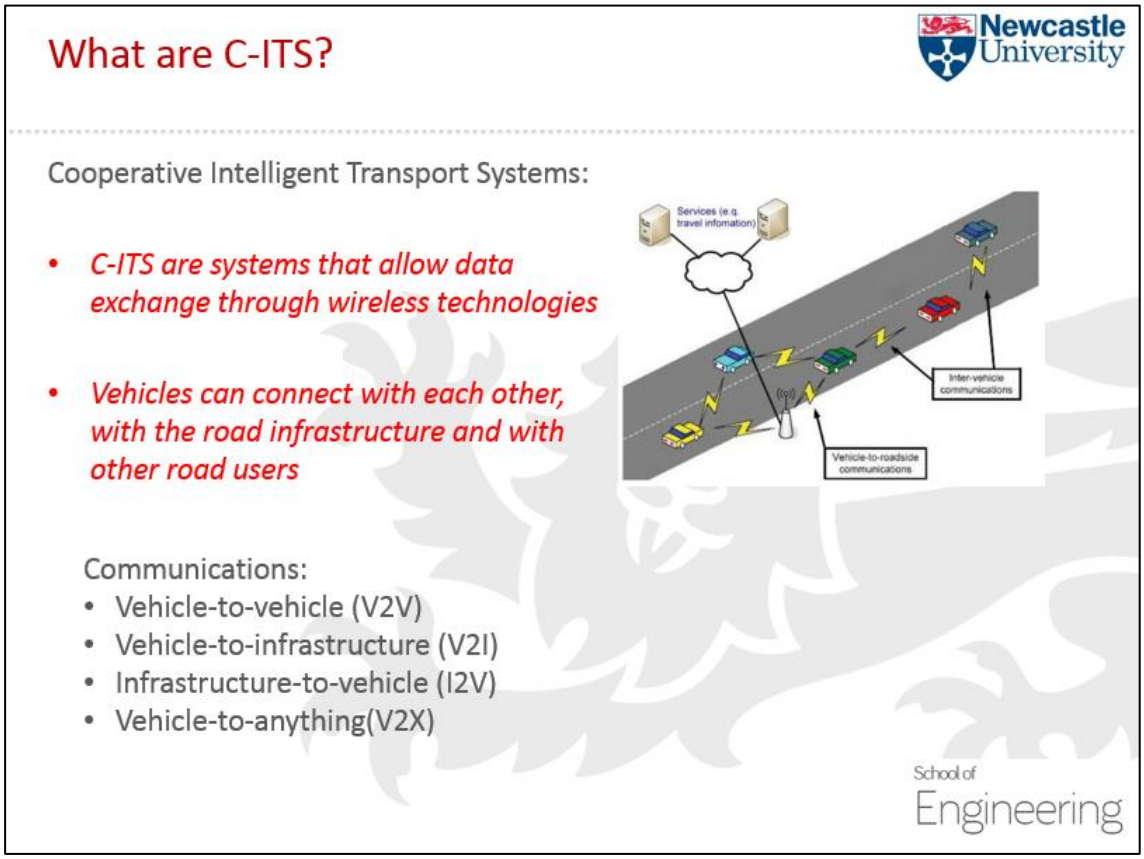


Figure 82: What are C-ITS?

Figure 83: What can C-ITS do for Newcastle

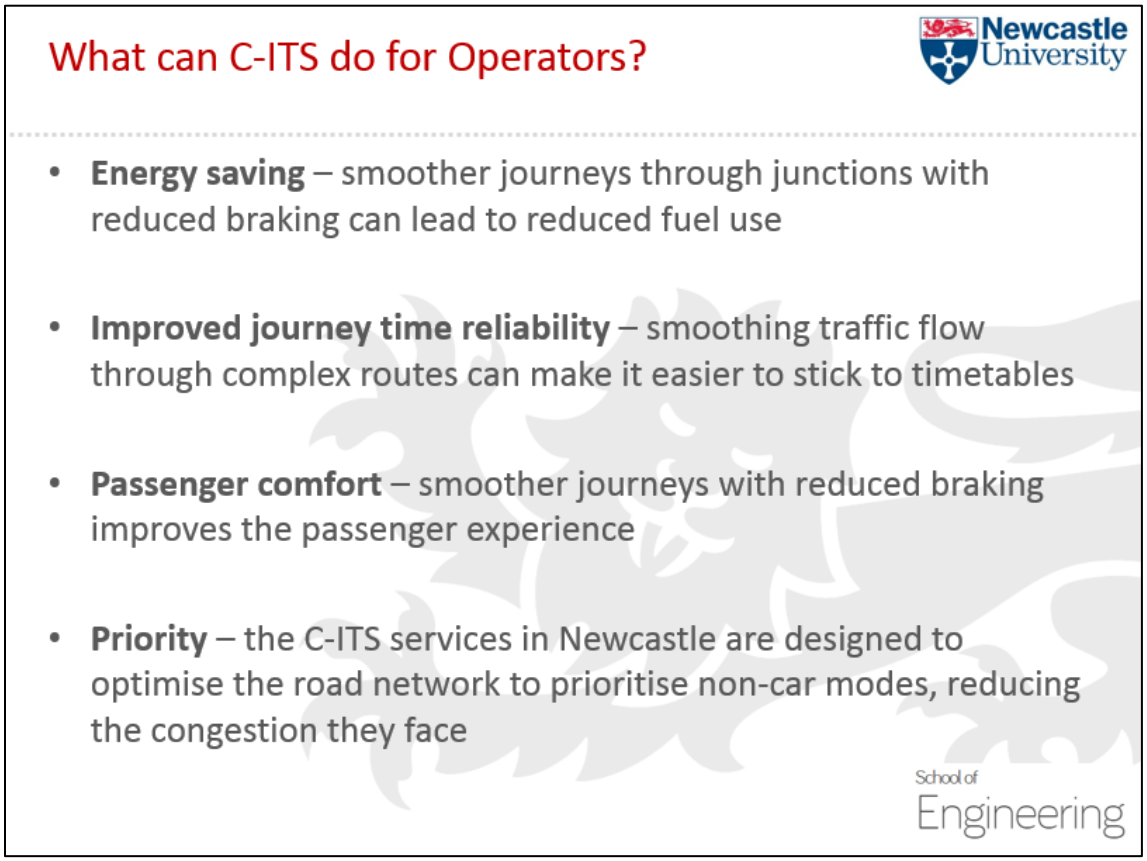


Figure 84: What can C-ITS do for Operators

Remaining slides focus on the C-ITS initiatives in Newcastle. Firstly, above, providing the rationale for the City's deployment of the technology.

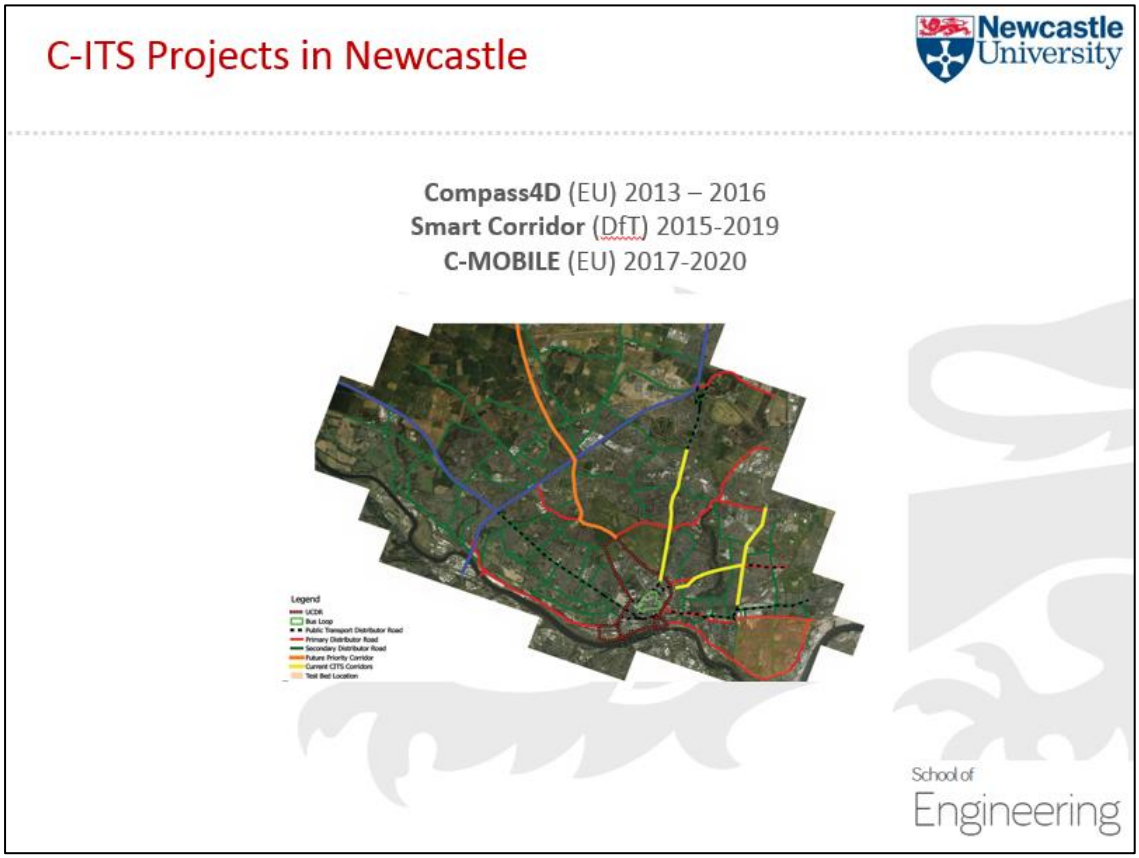


Figure 85: What can C-ITS do for Operators?

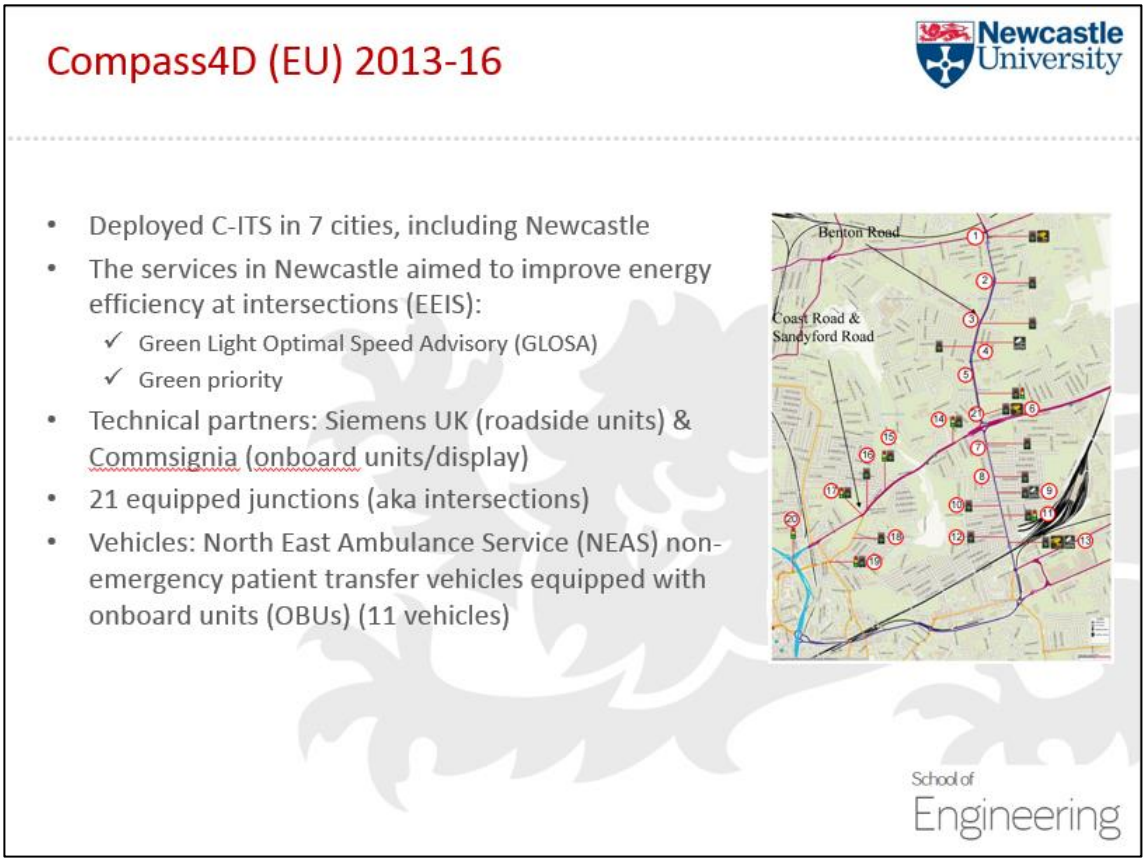


Figure 86: Compas4D

The next slides provide a summary of the three key projects: Compass4D, Smart Corridor, and C-MOBILE.

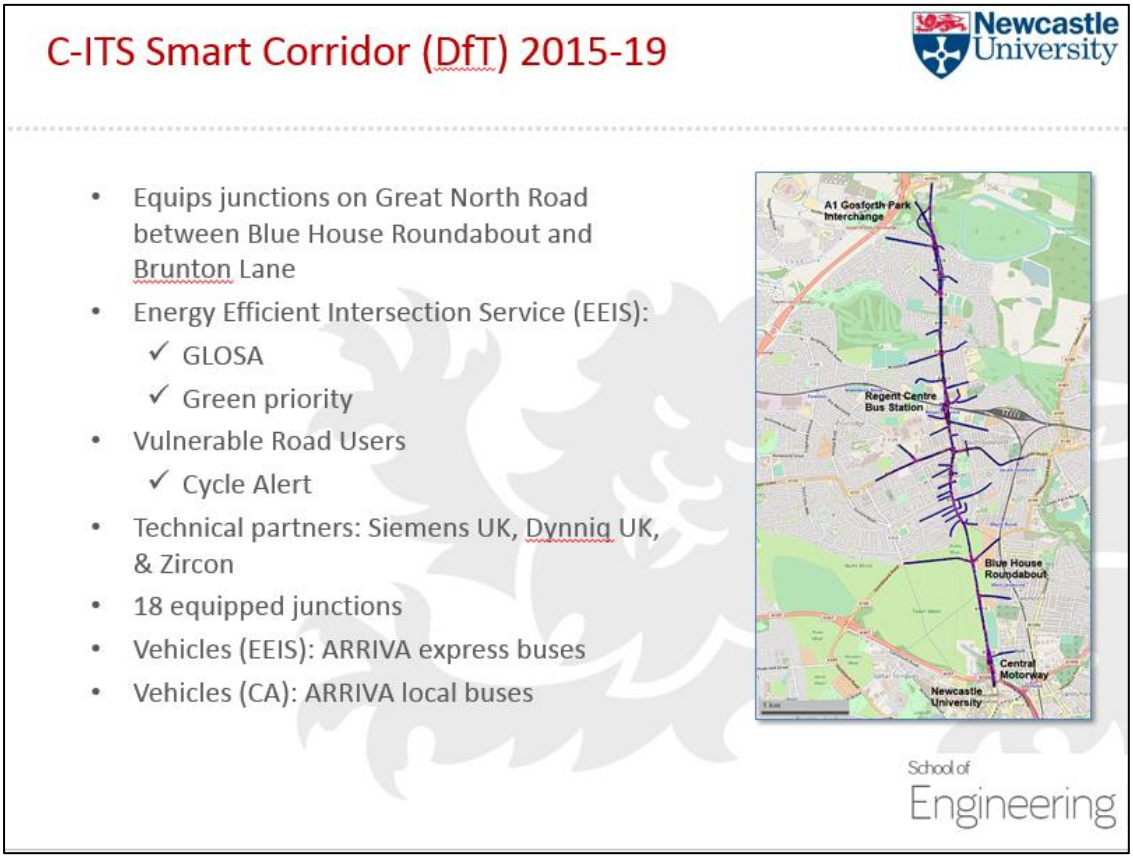


Figure 87: C-ITS Smart Corridor

Figure 88: C-MobILE

C-MOBILE: Bundling of Services

Newcastle University

Urban Efficiency	I2V Safety
Rest time management Motorway parking availability *Urban parking availability*	**Road work warning** **Road hazard warning** Emergency vehicle warning Signal violation warning *Warning system for pedestrians*
Traffic Efficiency	**V2V Safety**
Green priority **GLOSA** Cooperative traffic light for pedestrian *Flexible infrastructure* **In vehicle signage** Mode and trip time advice **Probe vehicle data**	Emergency brake light Adaptive cruise control Slow or stationary vehicle warning Motorcycle approaching indication **Blind spot detection (VRU)**

School of Engineering

Figure 89: Bundling services

C-MOBILE: GLOSA in Newcastle

Newcastle University

- Deployed on 39 RSUs across the two routes
- Corridors selected based on city policies to prioritise traffic
- Includes pedestrian crossings as well as standard priority traffic lights
- Infrastructure developed and installed by Siemens UK

School of Engineering

Figure 90: GLOSA in Newcastle

The remaining slides shown here form the majority of the presentation, and focus on the C-MOBILE vision in Newcastle.

C-MOBILE

Figure 91: Green Priority in Newcastle

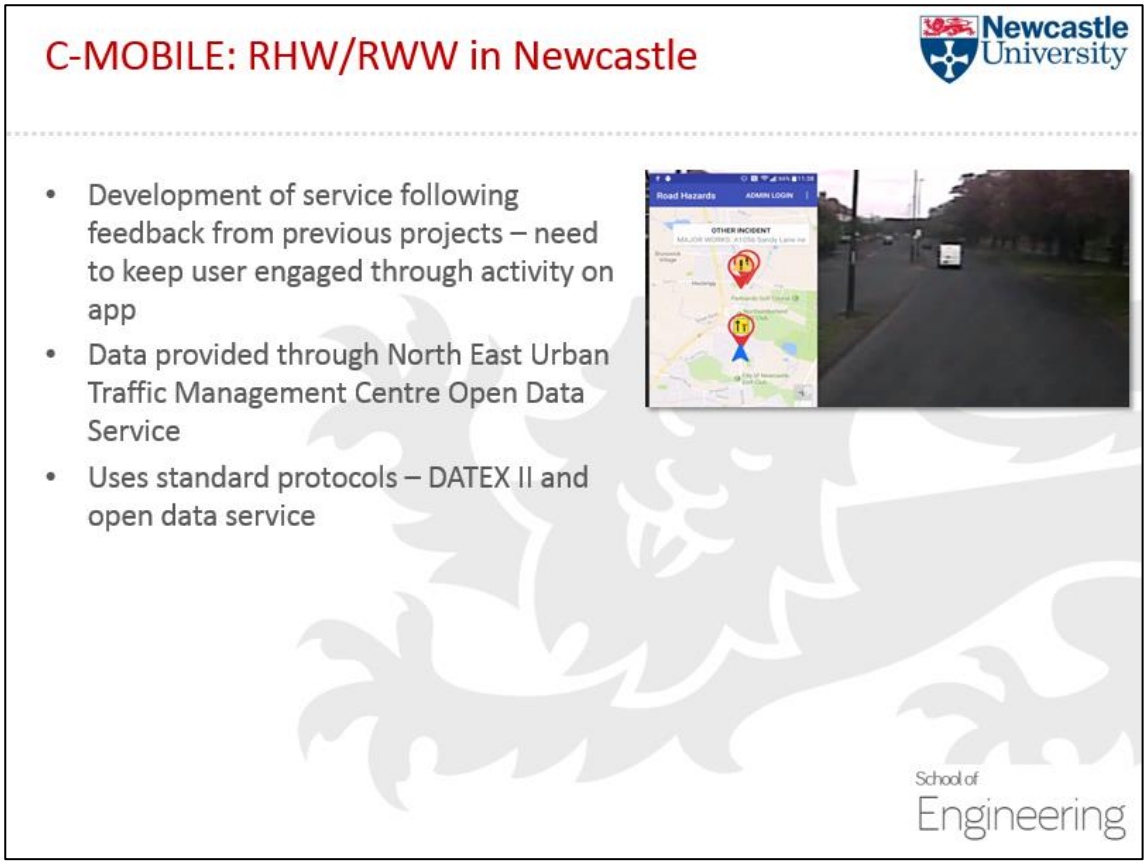


Figure 92: RHW/RWW in Newcastle

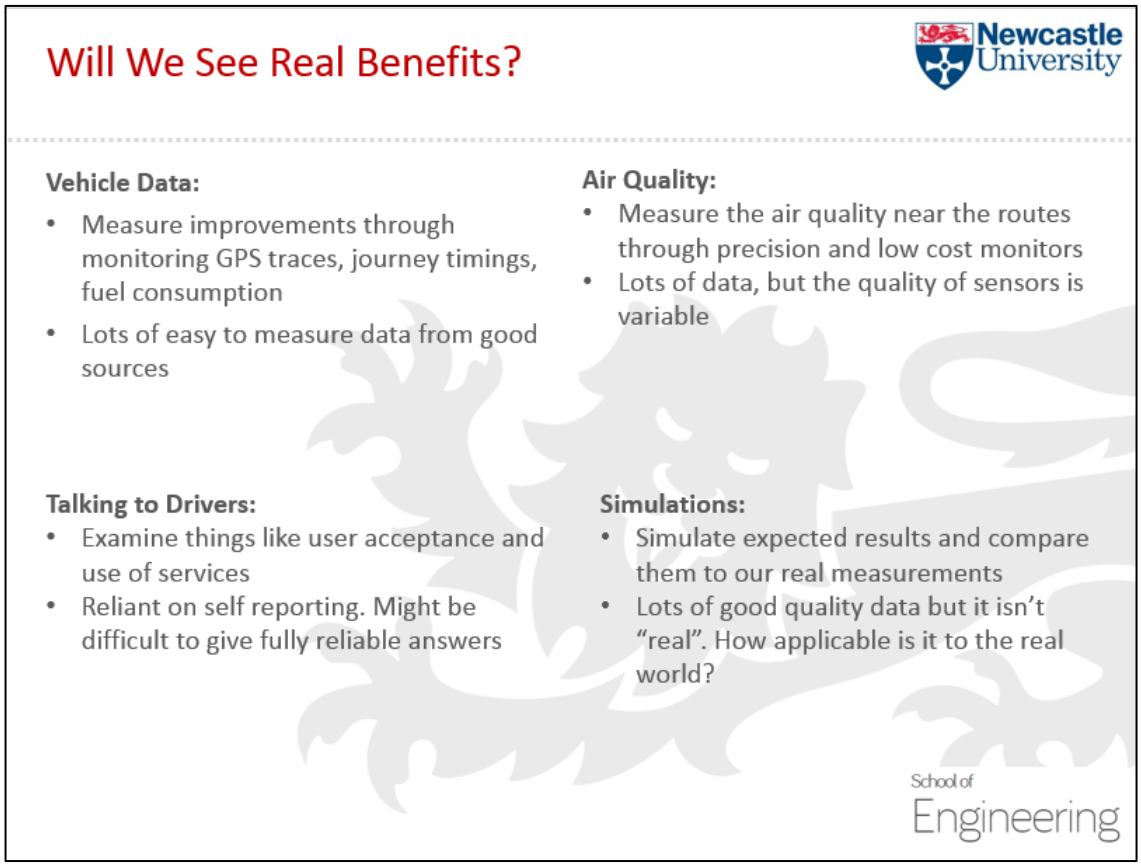


Figure 93: Benefits

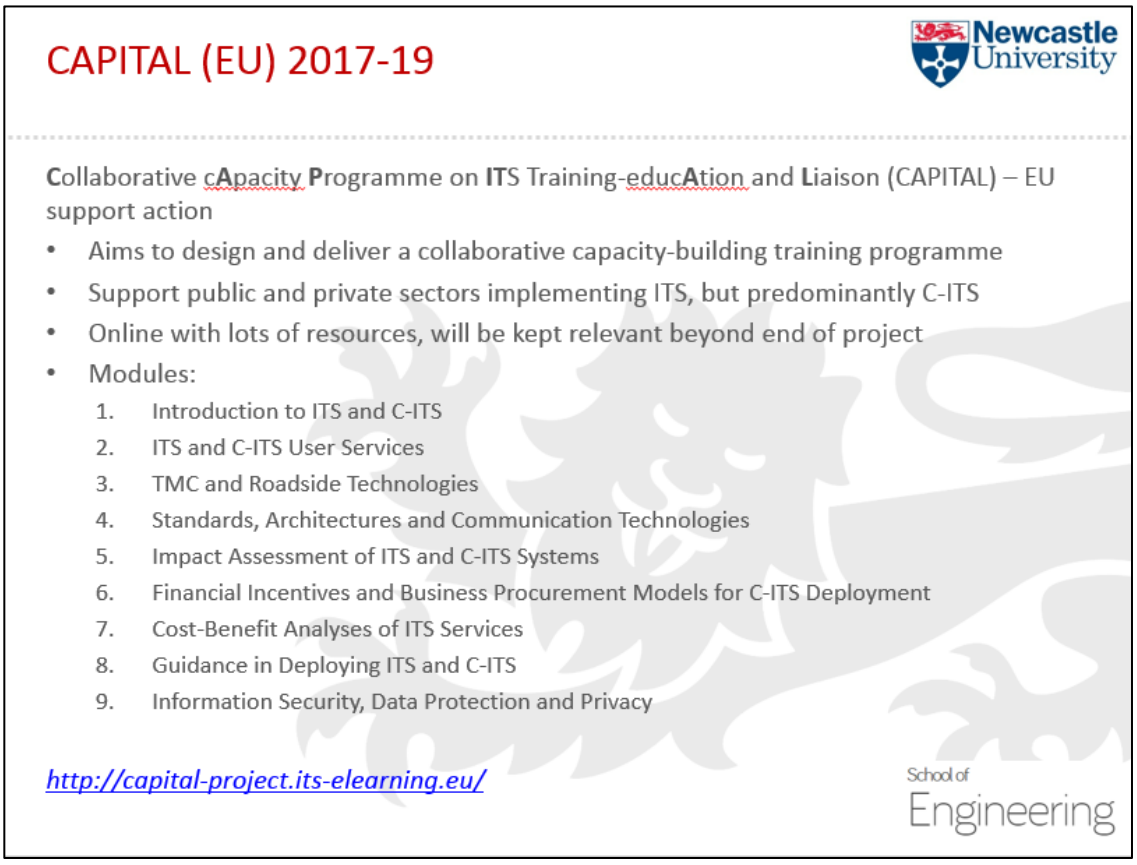


Figure 94: CAPITAL project

6.5.3. Practical module

6.5.3.1. Purpose of the module

The practical module provides first-hand experience of a selection of the services that are to be deployed in Newcastle. At the present time the equipped route is not available for a fully operational demo as testing and installation of on-board units is in process. There were also some logistical aspects to consider when organising the practical module, such as how to accommodate participants in a vehicle cab to look at an HMI whilst on the road. This would be physically challenging and in breach of regulations. On the other hand, taking one person in a vehicle at a time would take several hours. In the event, a combination of videos, scenario mock ups and showcases of different components of the technology, was provided to demonstrate to the drivers and managers the C-ITS technology. The showcases proved a popular aspect of the event, informing fleet operators of the requirements of installation, and potential interpretations of data for operational management purposes, including driving efficiency, as well as improved network management.

6.5.3.2. Description of covered materials

The full range of covered materials included:

- Scenario demos including screen views
- Mock-ups of the newly designed HMI for different services
- Video that shows the HMI screen changes as the route is driven
- Description of data that is being shown and how it is used
- OBU-equipped car.

6.6. North Brabant Deployment Site

6.6.1. Description of the North Brabant training

6.6.1.1. Purpose of the training

In the North Brabant deployment site we will organize two training sessions. One on the deployment site services and a second one for the practical module. The City of Helmond organized the first training session for end users of the North Brabant DS on February 12th. The host of the training was one of the end users, Van den Broek Logistics in Helmond. Such training was understood to be needed for showing the final users and testing users how the services would look like in North Brabant DS. This first training session is furthermore designed to act as publicity for the deployment site with a primary focus on the existing stakeholders, as well as on new ones. Some of the logistic partners and the fire brigade are familiar with the services, but other logistic partners, the ambulance and the police representatives are not. The event provides an opportunity to inform these stakeholders about the C-ITS deployment and its current status and forthcoming milestones, and also about the wider C-MOBILE project. We also feel that the training event provides us an opportunity to promote the C-ITS deployment through emphasising the positive benefits of C-ITS to the operators, and hopefully drivers. This is most likely to be successful through such a face to face workshop. Directly before the large-scale deployment we will organize a second training with the practical module, including instructions on how to use the devices and apps. This full practical training will take place when the on-board units/4G devices and HMIs are installed on the vehicles.

6.6.1.2. Participants of the training

Training did take place on Tuesday 12th February 2019 and had 30 participants. The participants represents the fleet operators who comprise the main end users in the North Brabant DS and the emergency services (Fire brigade, Ambulance, Police). Also some representatives from our technical partners, like Dynniq and Siemens, attend the training.

6.6.2. Deployment site C-ITS services module

6.6.2.1. Purpose of the module

The purpose of the module is to promote and publicise C-ITS in North Brabant, to provide an initial project-level training and introduction of selected services, to promote C-MobILE and to answer questions that the users may have about C-ITS and the C-ITS deployment/pilot within C-MobILE.

6.6.2.2. Description of covered materials

A selection of the presentation slides is included below:

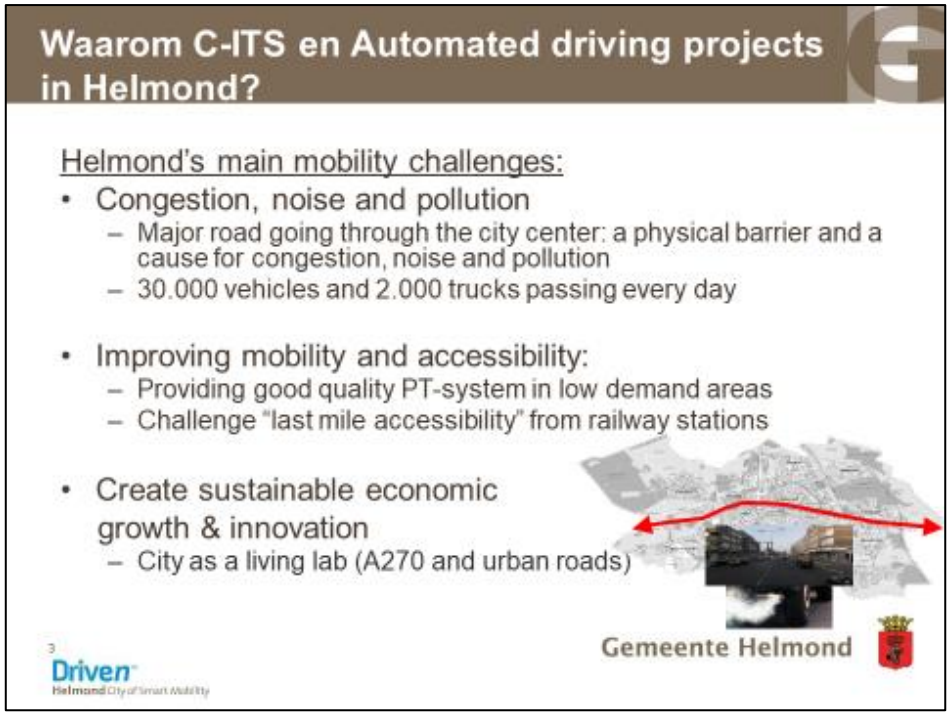


Figure 95: Why C-ITS and automated driving in Helmond?

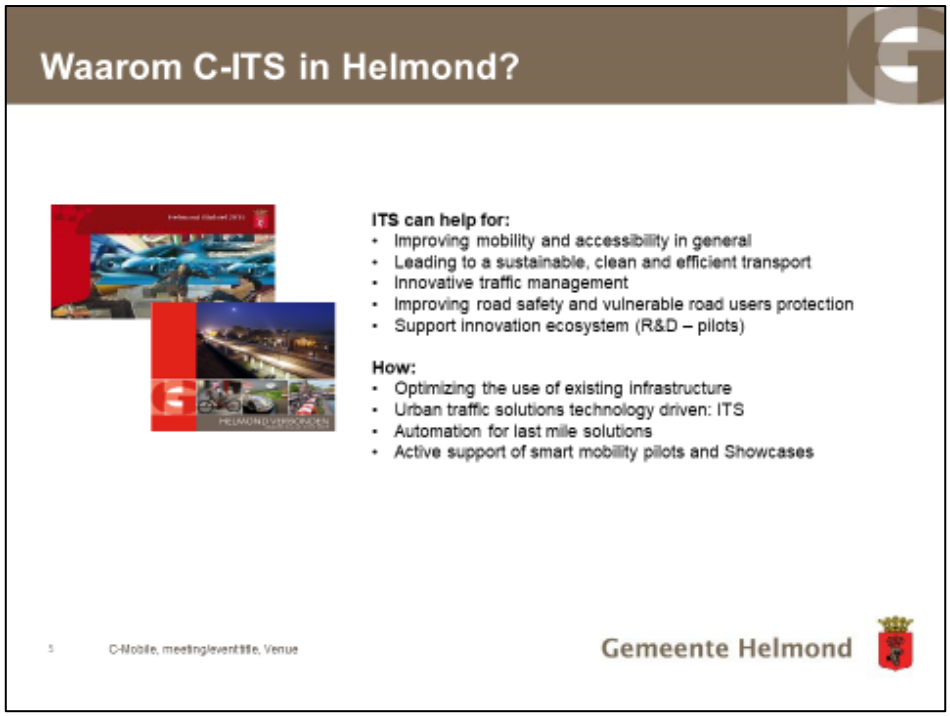


Figure 96: Benefits of C-ITS

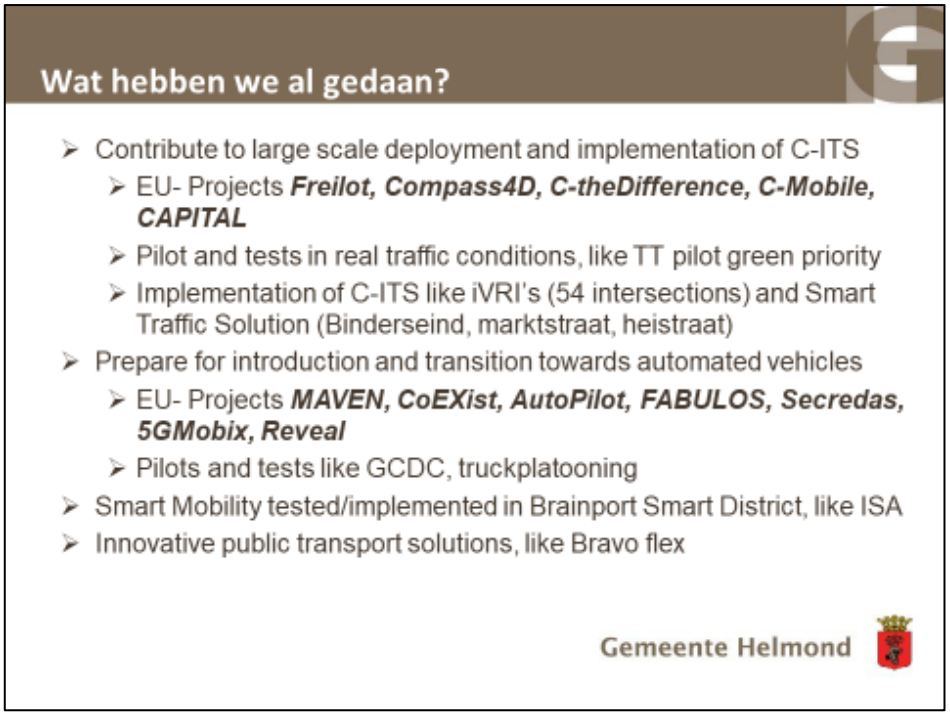


Figure 97: What has been already done?

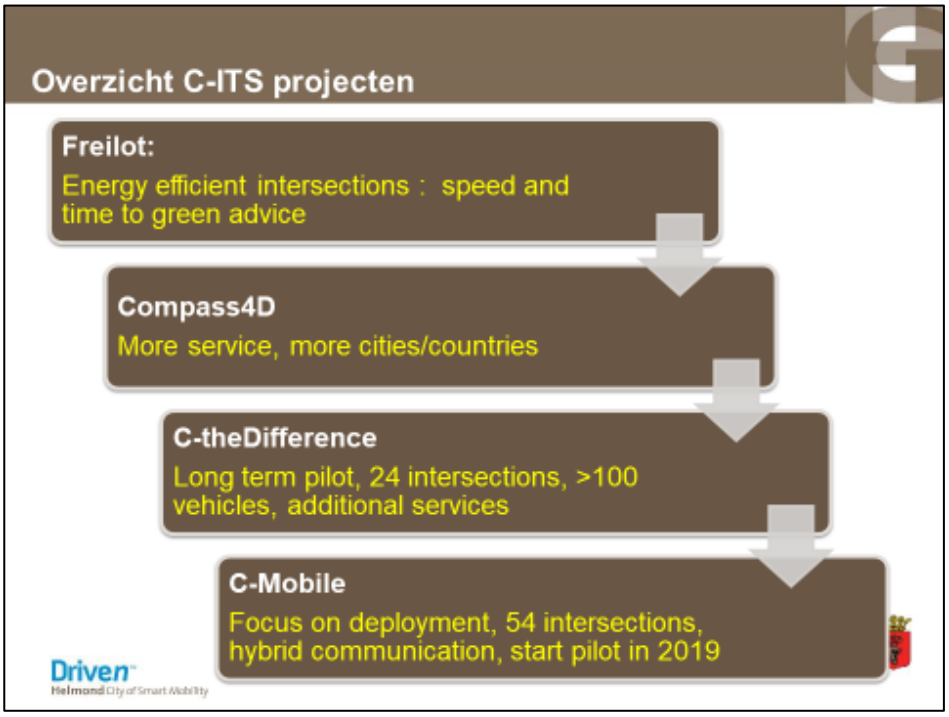


Figure 98: Overview of C-ITS projects

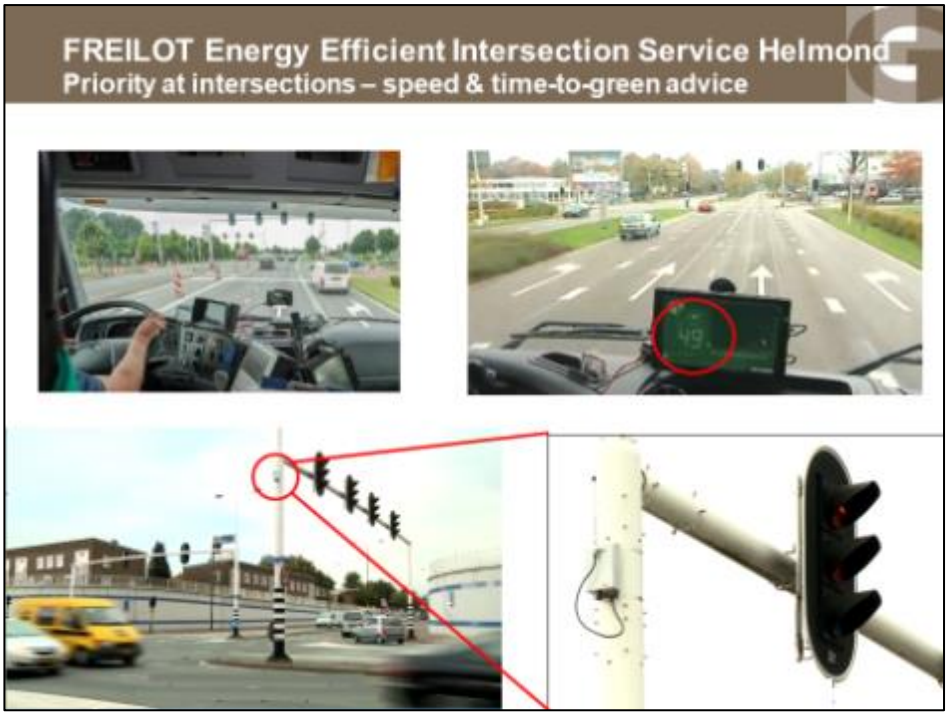


Figure 99: FREILOT Energy Efficiency Intersection Service in Helmond

Figure 100: Emergency Efficient Intersection Service

Overview of the C-ITS results of one of the previous projects. These are the effects of the Freilot project. This pilot was done with 10 heavy duty trucks and 4 emergency services vehicles on 14 intersections. The intersections are shown in the map (bullets). One of the most important results of the project is 13% less fuel consumption measured.

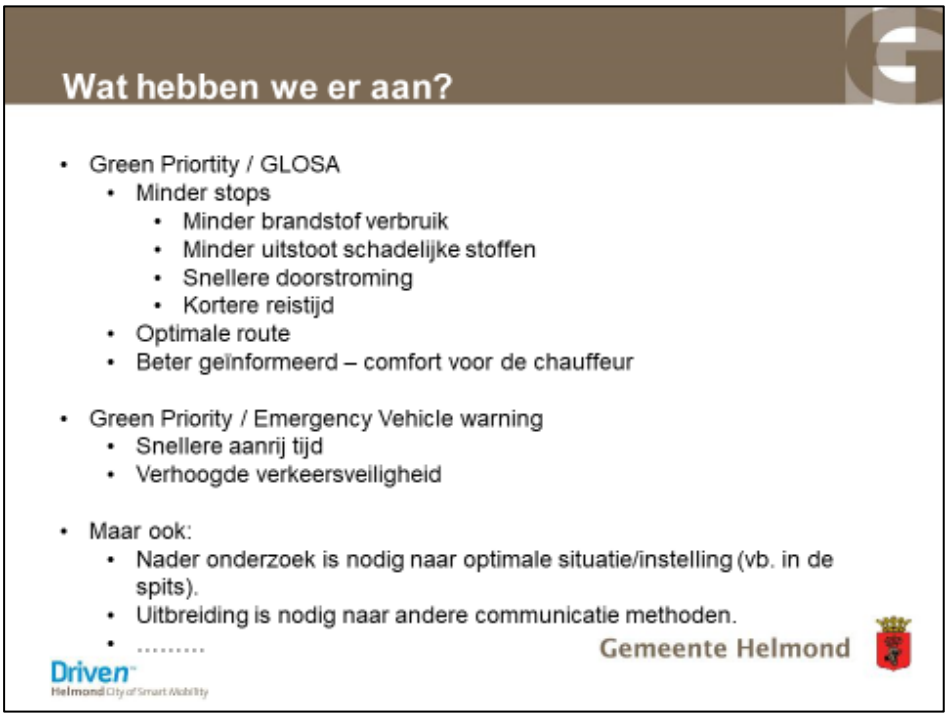


Figure 101: C-ITS services in Helmond

Overview of the benefits of C-ITS. First of all we gave an overview of the benefits of the combination of Green Priority and GLOSA, like less stops (less fuel consumption, better traffic flow, decreased travel time), better informed drivers (greater comfort for the driver). Secondly we describe the benefits of GLOSA for emergency vehicles in combination with EVW (like decrease in travel time to the incident, increased traffic safety). Last, but not least we also give attention to the next steps.

Overview of the plans for 2019. We are going to test/deploy 4 services on behalf of four different projects. C-Mobile, but also Intercor and the Dutch Talking Traffic programme. We also gave the reasons why we are doing this (specified per project).

Figure 102: C-ITS services of 2019 in Helmond

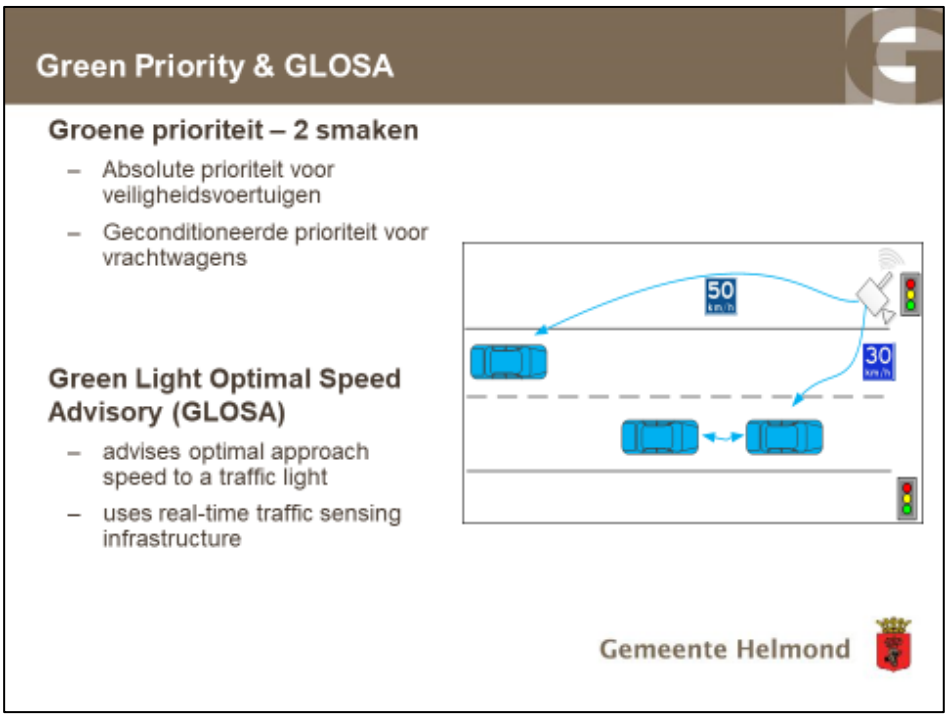


Figure 103: Description on Green Priority and GLOSA

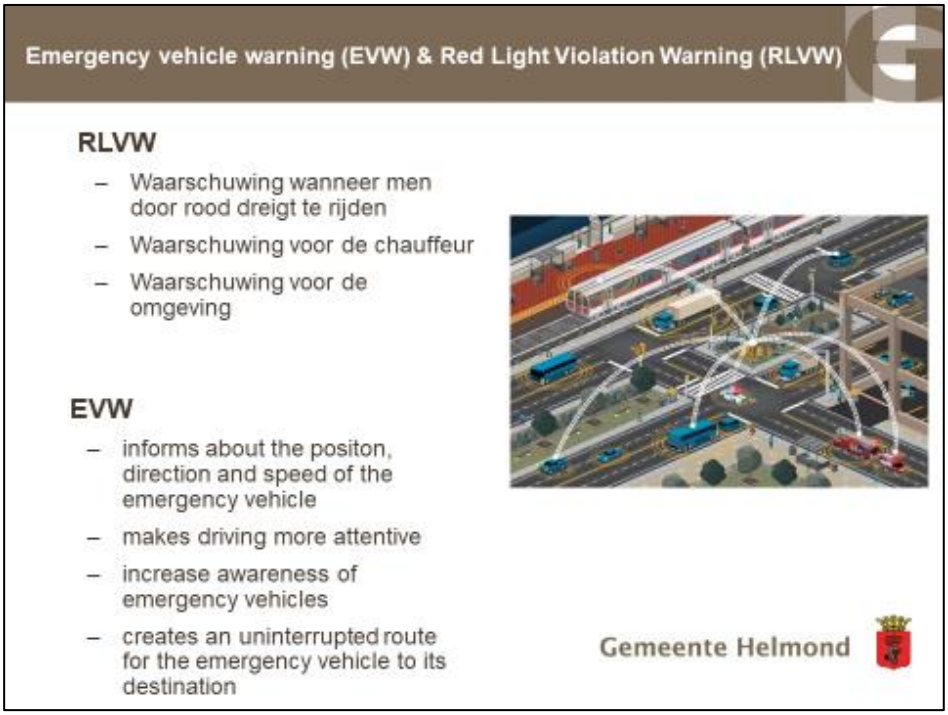


Figure 104: Emergency Vehicle Warning and Red Light Violation Warning

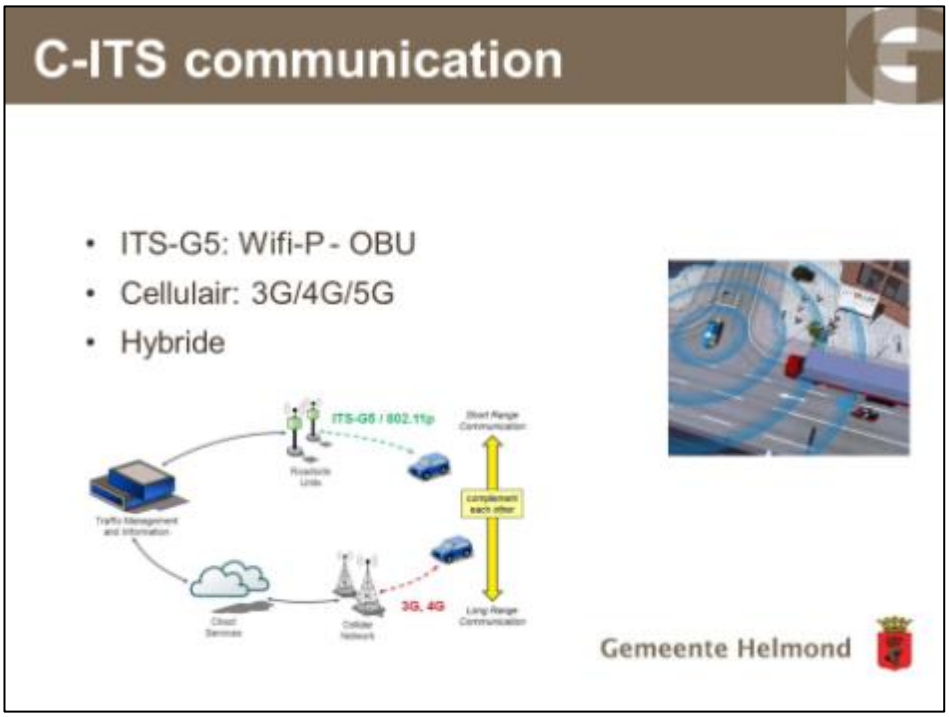


Figure 105: C-ITS communication technology

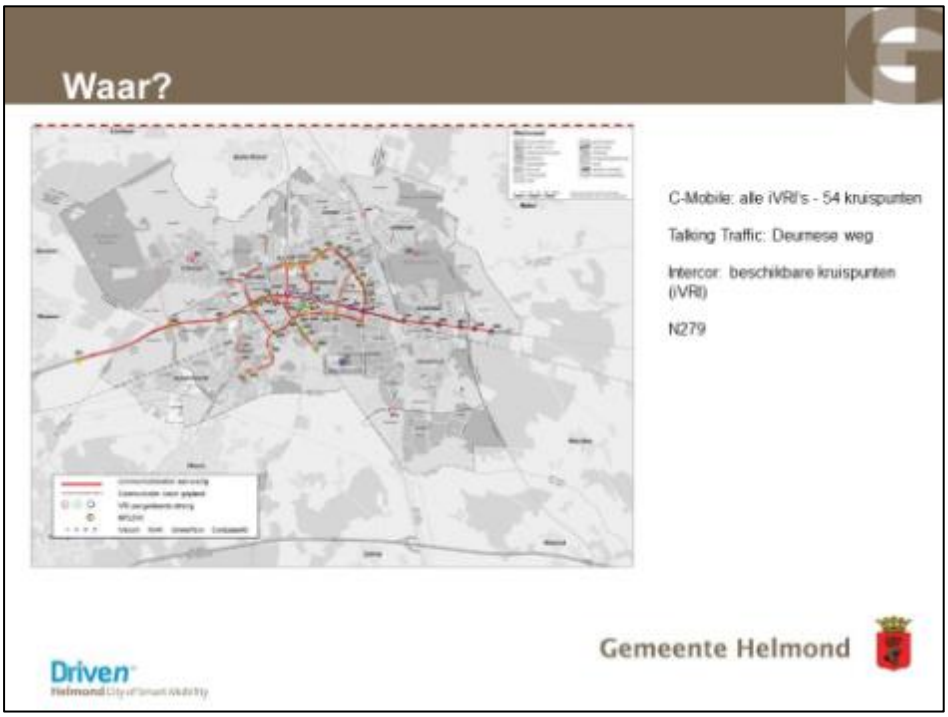


Figure 106: Overview of Helmond DS

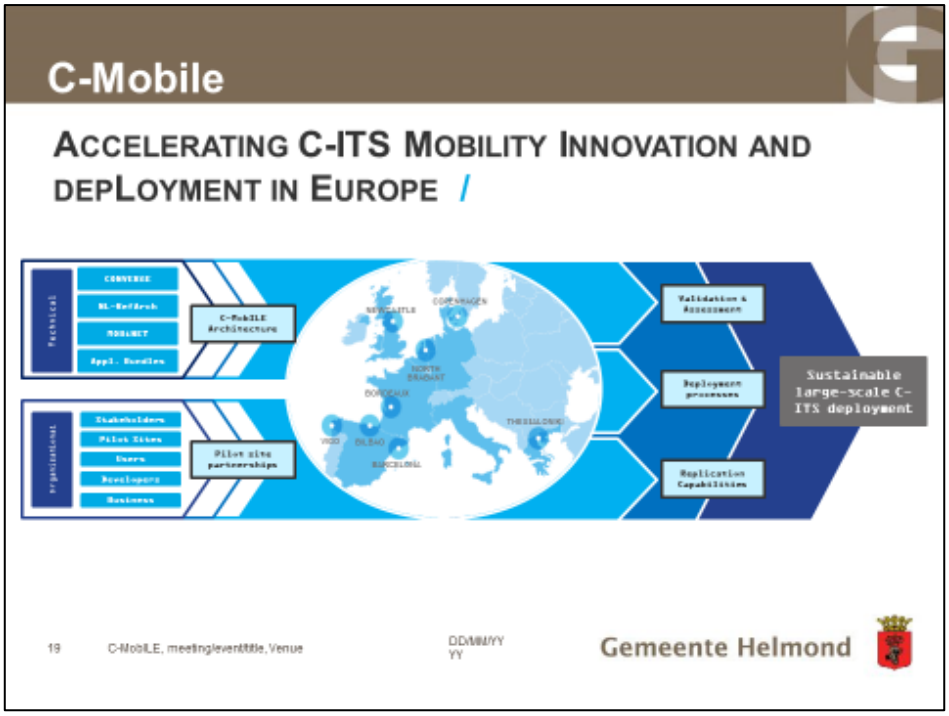


Figure 107: C-Mobile project

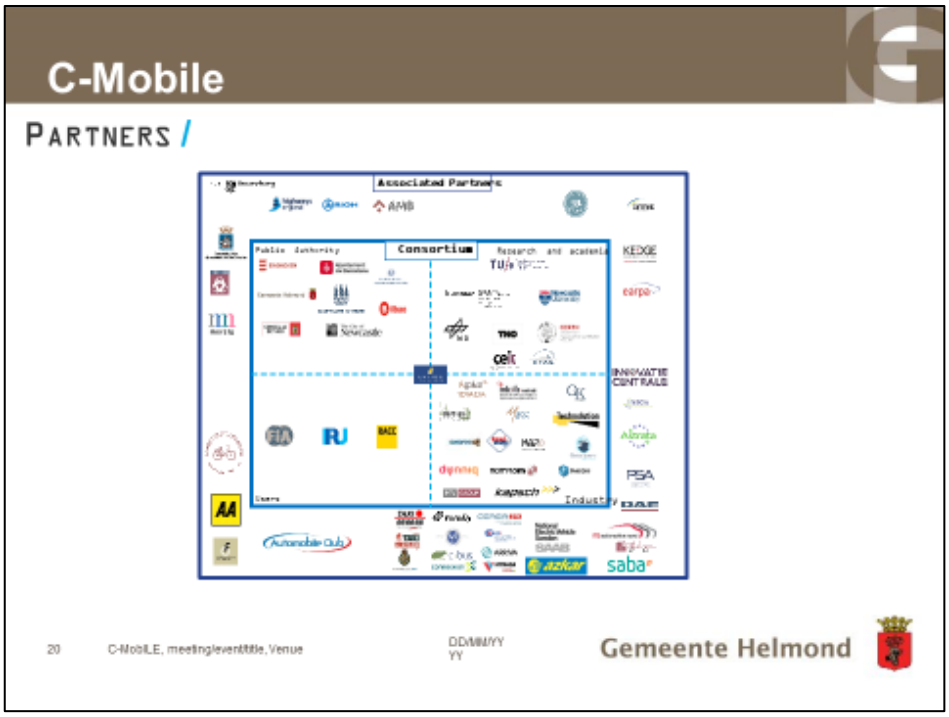


Figure 108: C-Mobile partners

Figure 109: Planning of C-ITS services

6.6.3. Practical module

6.6.3.1. Purpose of the module

The practical module will show the technologies used, the HMI and devices used and a detailed instruction on how to use these.

6.6.3.2. Description of covered materials

Besides a presentation, we intent to give to the participants a short leaflet including a summary of relevant C-ITS use cases developed and deployed in the North Brabant deployment site. The leaflet will also include the map of the deployment site with all the relevant C-ITS services they will encounter along the way.

Slide showing a case of Road Works Warning (RWW) service. The slide includes when the RWW are expected to be received by the driver and also a video showing the RWW notification while driving on a main road in Barcelona.

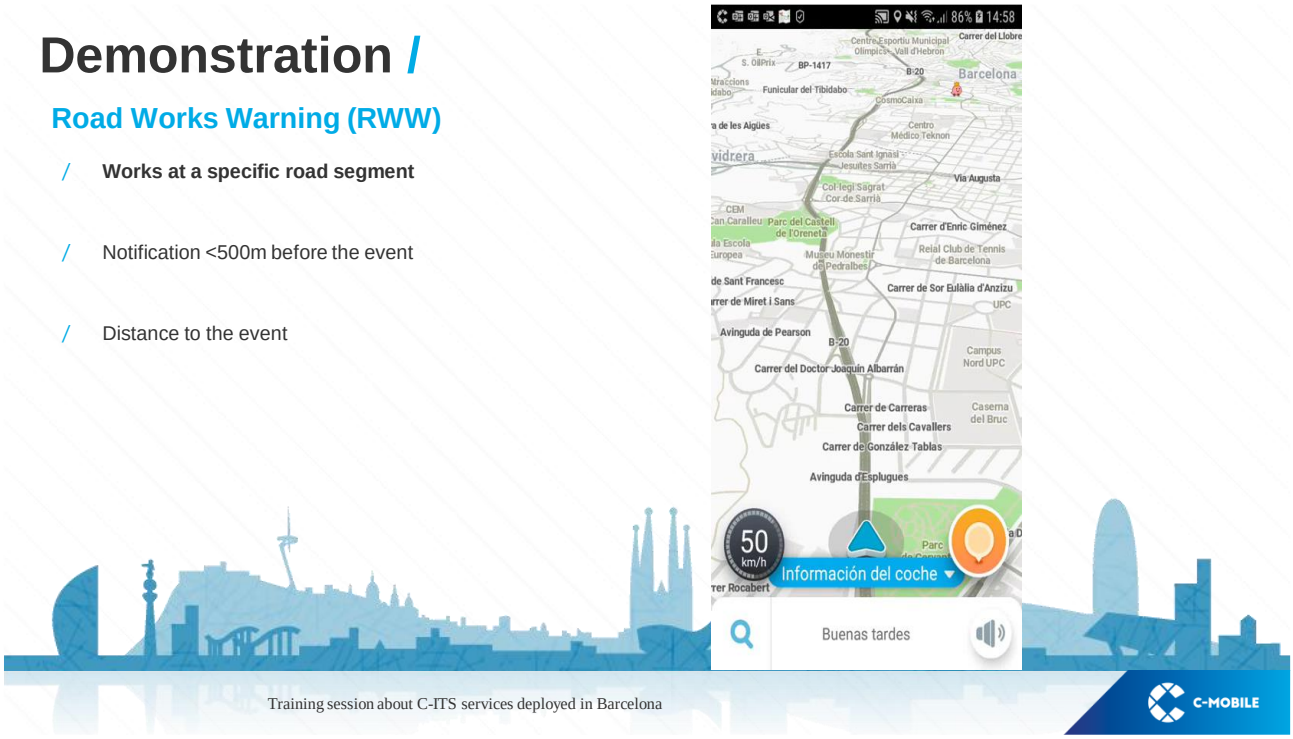


Figure 110: Demonstration of Road Works Warning (RWW)

A video is included showing the app icon, main and settings screen.

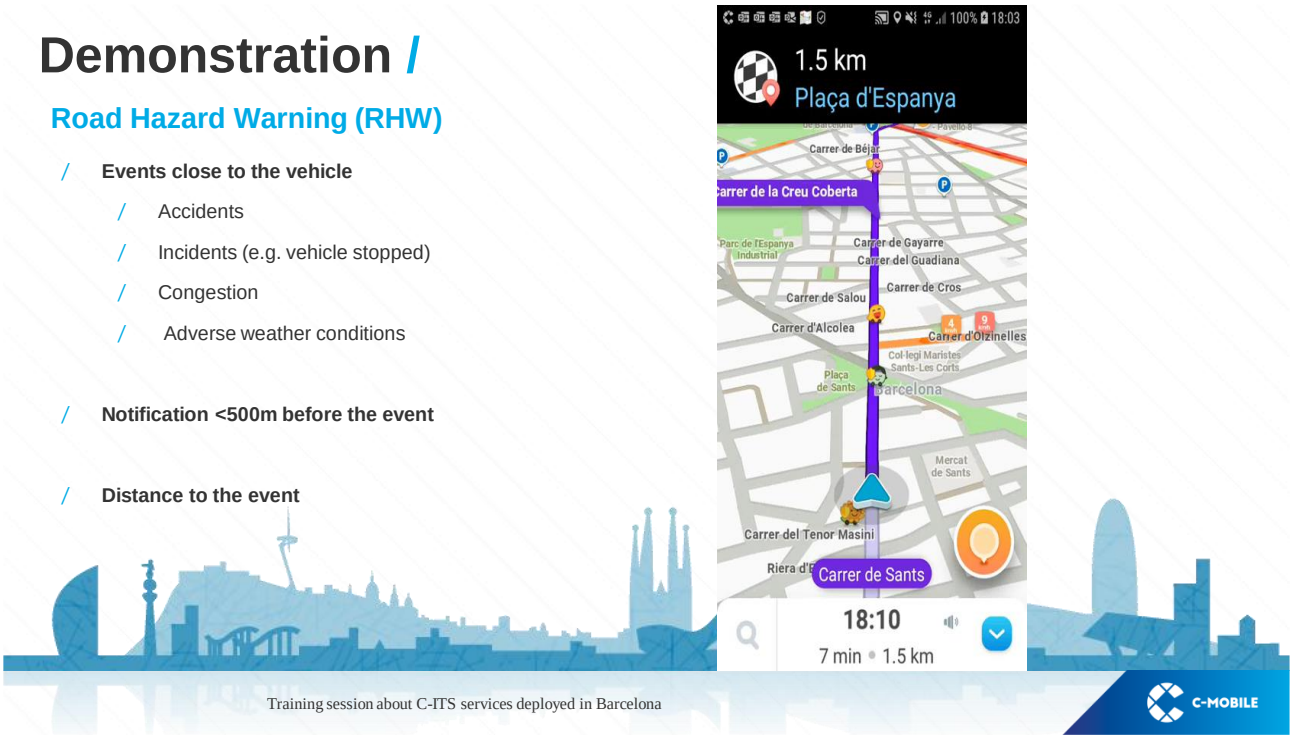


Figure 111: Demonstration of Road Hazard Warning (RHW)

Road Hazard Warning (RHW) service is presented in this slide. Some information is shown regarding the different hazard types available in Barcelona and how in advance the notification will be presented.

6.7. Thessaloniki Deployment Site

6.7.1. Description of Thessaloniki training

The training on C-ITS services for professional drivers took place in the premises of CERTH in Thessaloniki. The training event was organized with the collaboration of the C-MobILE project partners IRU and CERTH, which is the Thessaloniki Deployment Site Leader. The event date was set as the 31st of May 2019 in agreement with both partners.

6.7.1.1. Purpose of the training

The objective of the training event was to introduce professional drivers to C-ITS services as well as to provide explicit information on the services implemented in Thessaloniki. The training was targeting to the understanding of C-ITS technologies by the drivers and to the presentation of the App developed by CERTH for Thessaloniki.

6.7.1.2. Participants of the training

The targeted audience of the training event in Thessaloniki were professional drivers, and more specifically taxi drivers of the C-MobILE partner Taxiway. Taxiway is a taxi fleet operator company located in Thessaloniki. The reason for such a targeted training was because taxi drivers constitute a big number of end-users (600 taxi drivers) for the Thessaloniki Deployment Site. The training event would facilitate the use of the App developed by CERTH and hence contribute to the large-scale demonstration in Thessaloniki.

6.7.2. Deployment site C-ITS services module

The structure of the training event was comprised of the following parts: Introduction to ITS and C-ITS technologies, C-ITS services and applications deployed in Thessaloniki, a knowledge test and a survey, as well as a hands-on testing of C-ITS services combined with driving of connected vehicles.

6.7.2.1. Purpose of the module

Concerning the deployment site - specific modules, the session had the objective to elaborate on a specific number of C-ITS services implemented in Thessaloniki and on the App for end-users. For this purpose, the attendees were first provided with an overview of the technological development in the transport domain, in order to get familiar with the concept of innovative technologies such as C-ITS. Then a comprehensive description of the vision and the objectives of the C-MobILE project was presented. The main part of the module was dedicated to the large-scale demonstration of C-ITS services in Thessaloniki, hence providing an explicit description of the available C-ITS services. More specifically, in this part of the module valuable information, such as services definition, objectives, functions and benefits, was presented to the attendees. The list of C-ITS services included GLOSA, Road Hazard Warning, Road Works Waring, In-Vehicle Signage, Mode and Trip Time Advice, and Probe Vehicle Data. Next, the focus of the module was on the type of information provided by each service and the coverage area. In this part big focus was given on the App, developed by CERTH, which provides the whole suite of C-ITS services available in Thessaloniki. Information on the HMI, types of notifications, and symbols shown were presented to the attendees. Completing this module attendees had to take part in the interactive session which included a quiz and filling in questionnaires. After this interactive session quiz winners were rewarded with participation certificates.

6.7.2.2. Description of covered materials

Some indicative slides of the presentation are provided below:

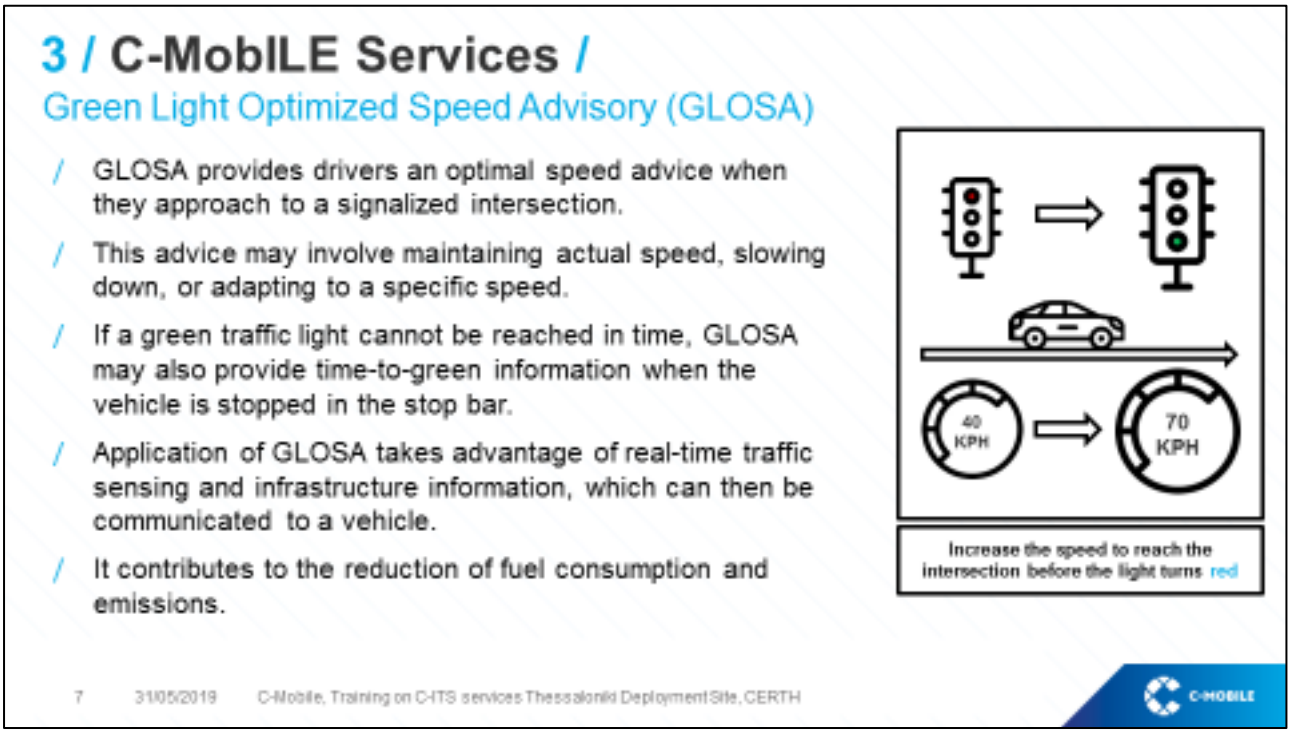


Figure 112: Description of GLOSA

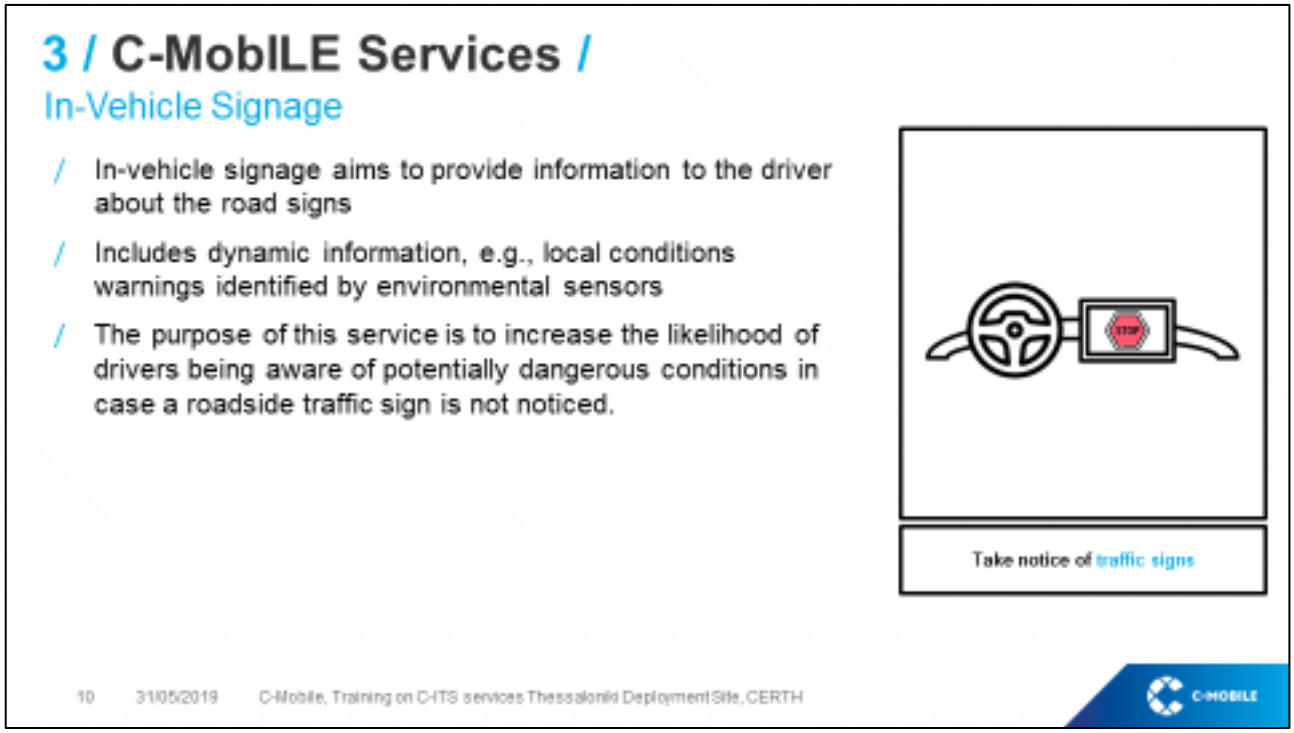


Figure 113: Description In-Vehicle Signage

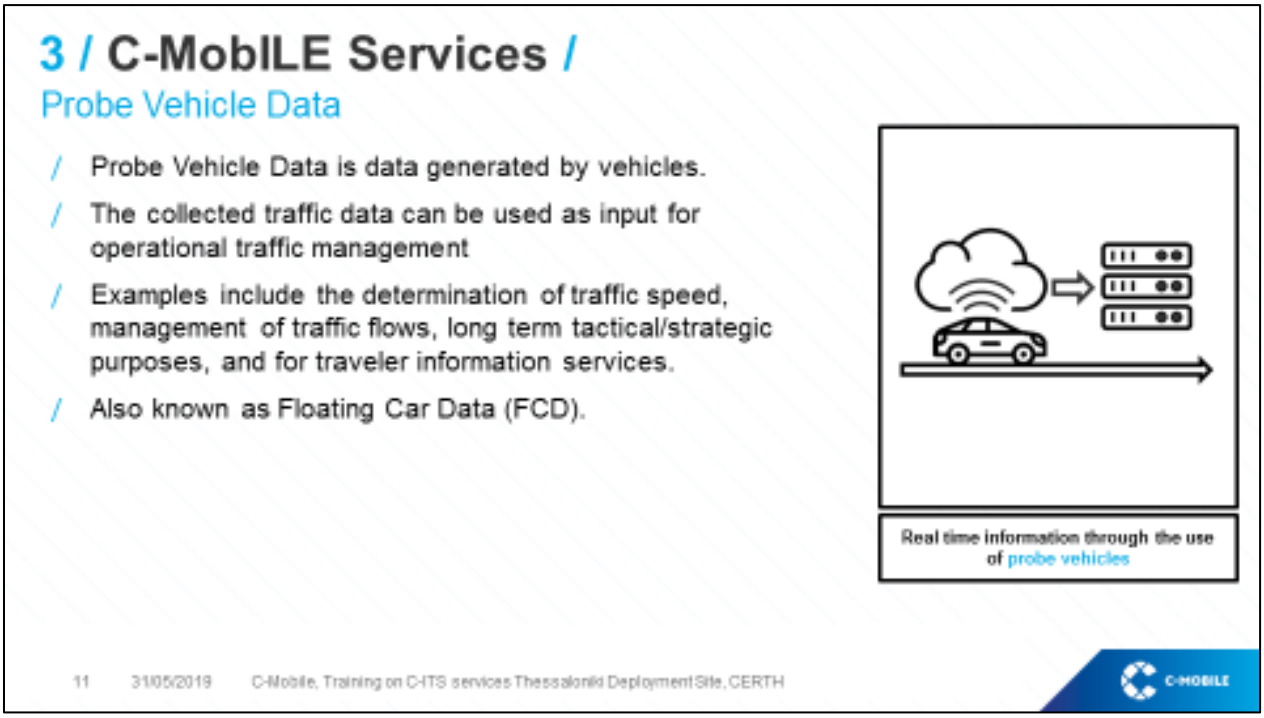


Figure 114: Probe vehicle Data

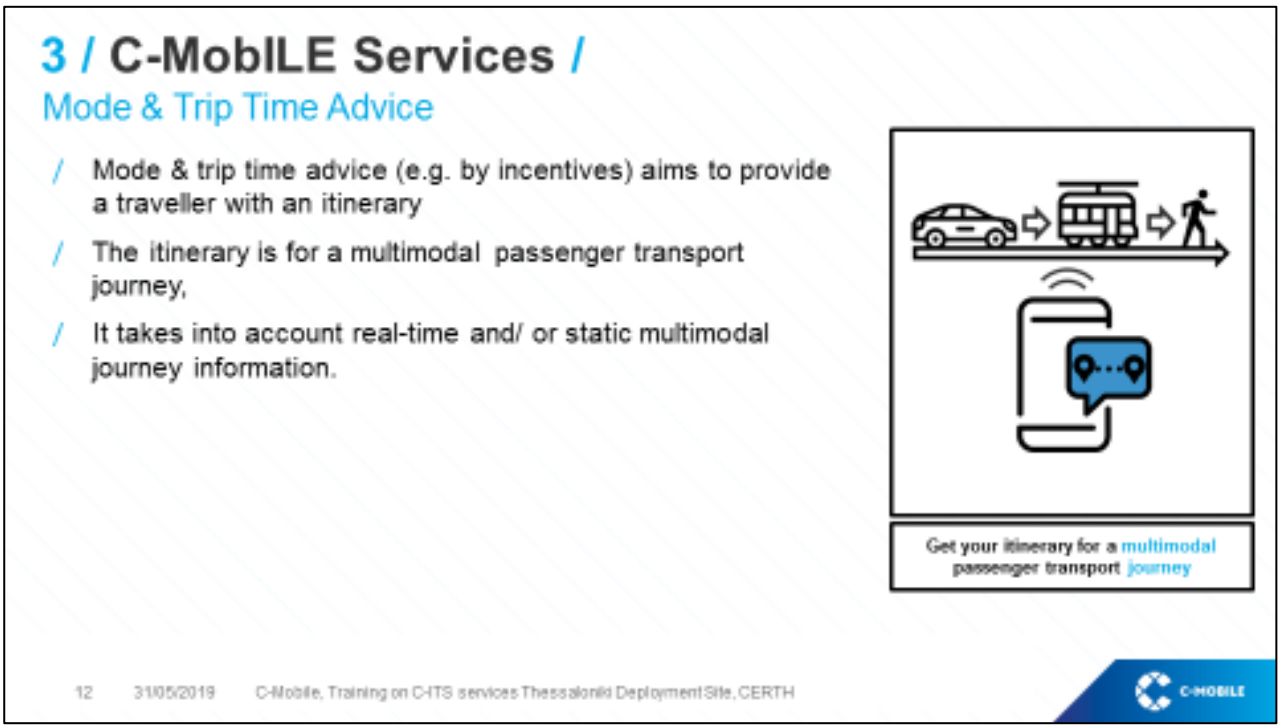


Figure 115: Mode & Trip Time Advice

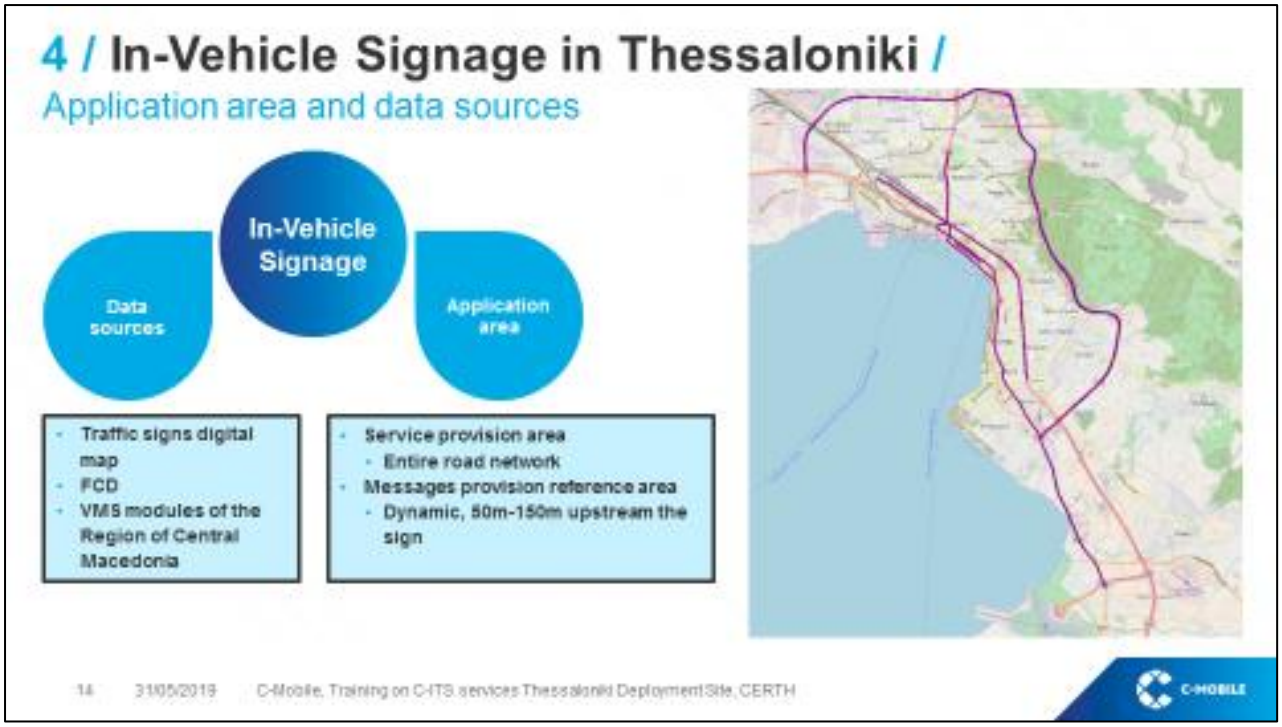


Figure 116: Description of data sources and geographical coverage area for In-Vehicle Signage

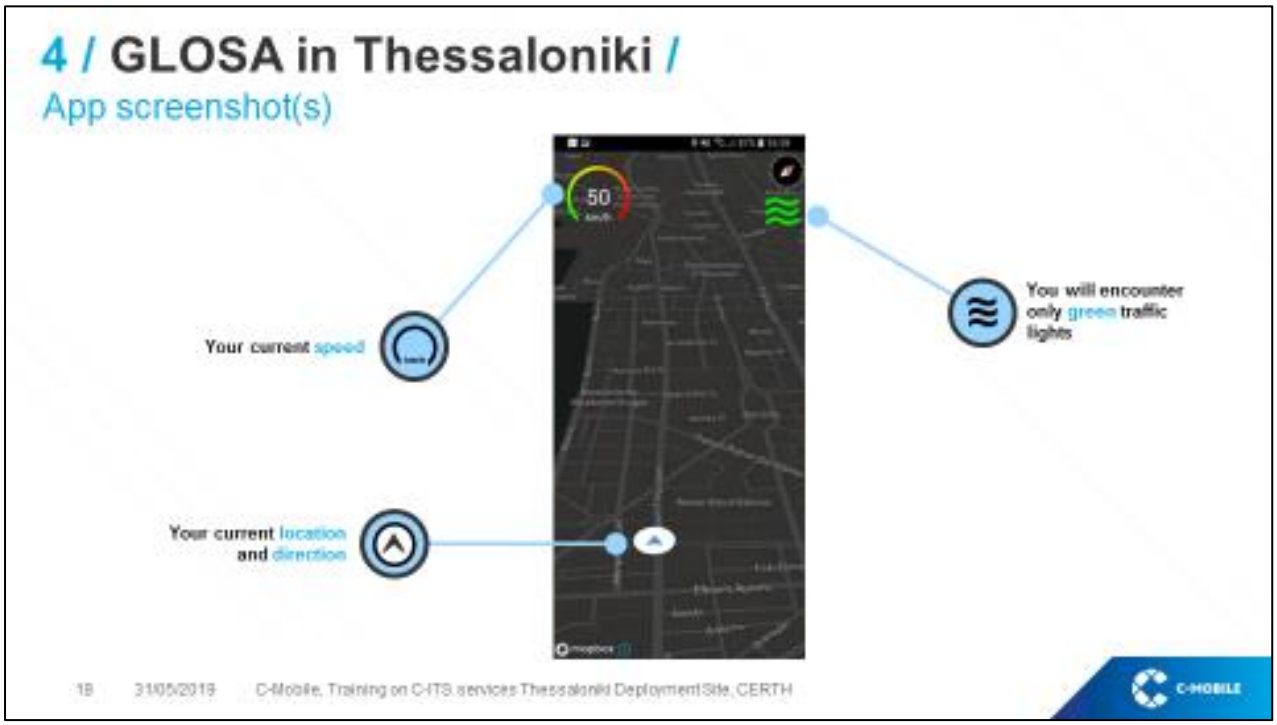


Figure 117: Description of App HMI for GLOSA

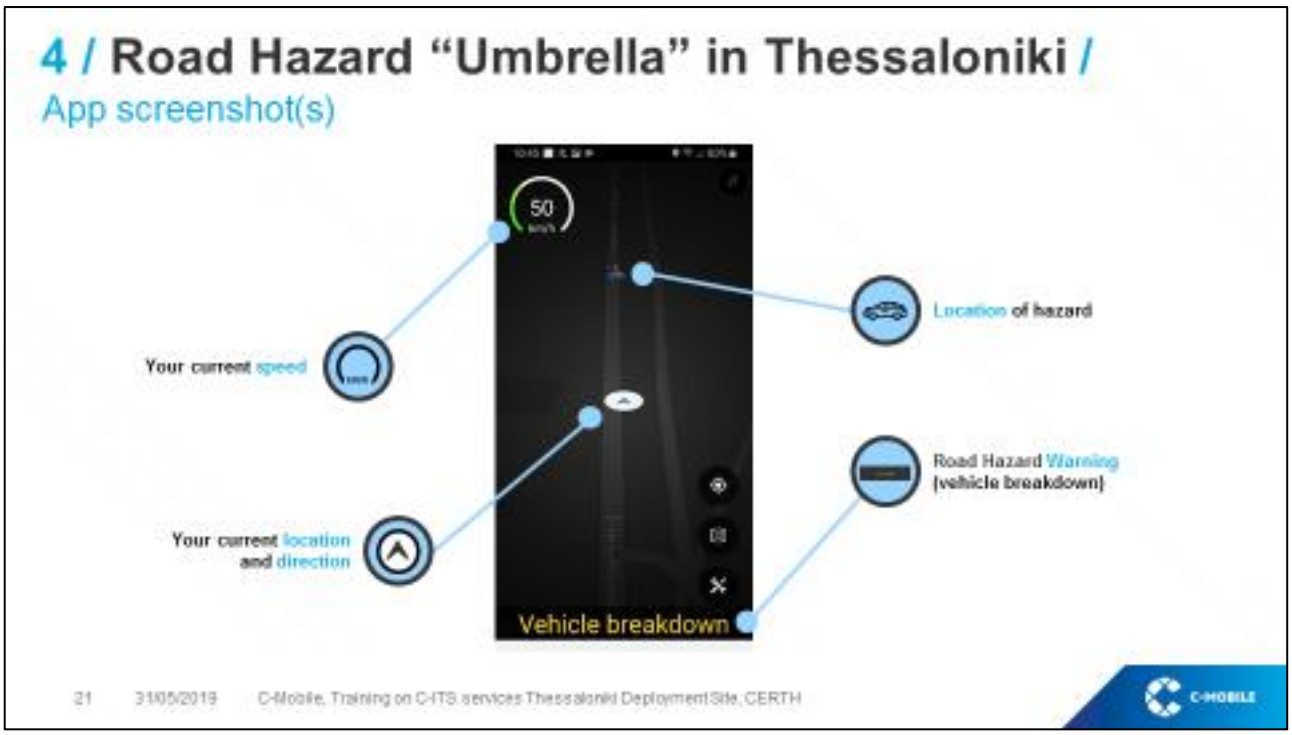


Figure 118: Description of App HMI for RWW-RHW-FI

6.7.3. Practical module

6.7.3.1. Purpose of the module

This part of the training event included hands-on testing of C-ITS services and driving of connected vehicles. For this purpose, a demo was organized covering a specific route near CERTH premises. During the demo, groups of attendees had the opportunity to have a ride along specific roads and watch the App functioning in real world environment. The attendees were able to see notifications of the services GLOSA, RWW, RHW, and In-Vehicle Signage.

6.7.3.2. Description of covered materials

During this module the attendees were provided with C-MobILE leaflets, as well as car stickers created and distributed by CERTH. The stickers included the C-MobILE logo and slogans.

6.8. Vigo Deployment Site

6.8.1. Description of Vigo training

CTAG as organizer and host and IRU as supporter and leader of the training sessions in every site of the project, organized the training event in Vigo that will be celebrated the 20th of June in the CTAG facilities.

6.8.1.1. Purpose of the training

The objective of this event is to give knowledge to the attendees about what services are deployed in the city of Vigo as Deployment Site of the project, what they look like and what they could use in the future. How to use them, needs and benefits will be presented as well.

6.8.1.2. Participants of the training

The target audience of this event are basically professional drivers and companies with logistic capabilities, in the region of Vigo, who may be interested in the use of the services that will be presented in the event. Also traffic authorities and road operators are invited to this event.

6.8.2. Deployment site C-ITS services module

6.8.2.1. Purpose of the module

During the event, the following services will be presented as services deployed at the city of Vigo as Deployment Site of the C-MOBILE project:

- Road Work Warning
- Road Hazard Warning
- Emergency Vehicle Warning
- Signal Violation Warning
- Warning for pedestrian
- GLOSA
- In-vehicle signage
- Probe Vehicle Data
- Emergency Brake Light
- Slow/Stationary Vehicle Warning
- Motorcycle approaching indication

From this list of services, the following ones will be presented during the event in a practical way, to allow the participants to have a knowledge beyond the theory about them:

- GLOSA
- Road Hazard Warning

6.8.2.2. Description of covered materials

During the event, presentations, media content and prototypes will be presented. The most important presentation will be about which services are deployed in the city of Vigo, how they work, elements involved and the benefits of using of them.

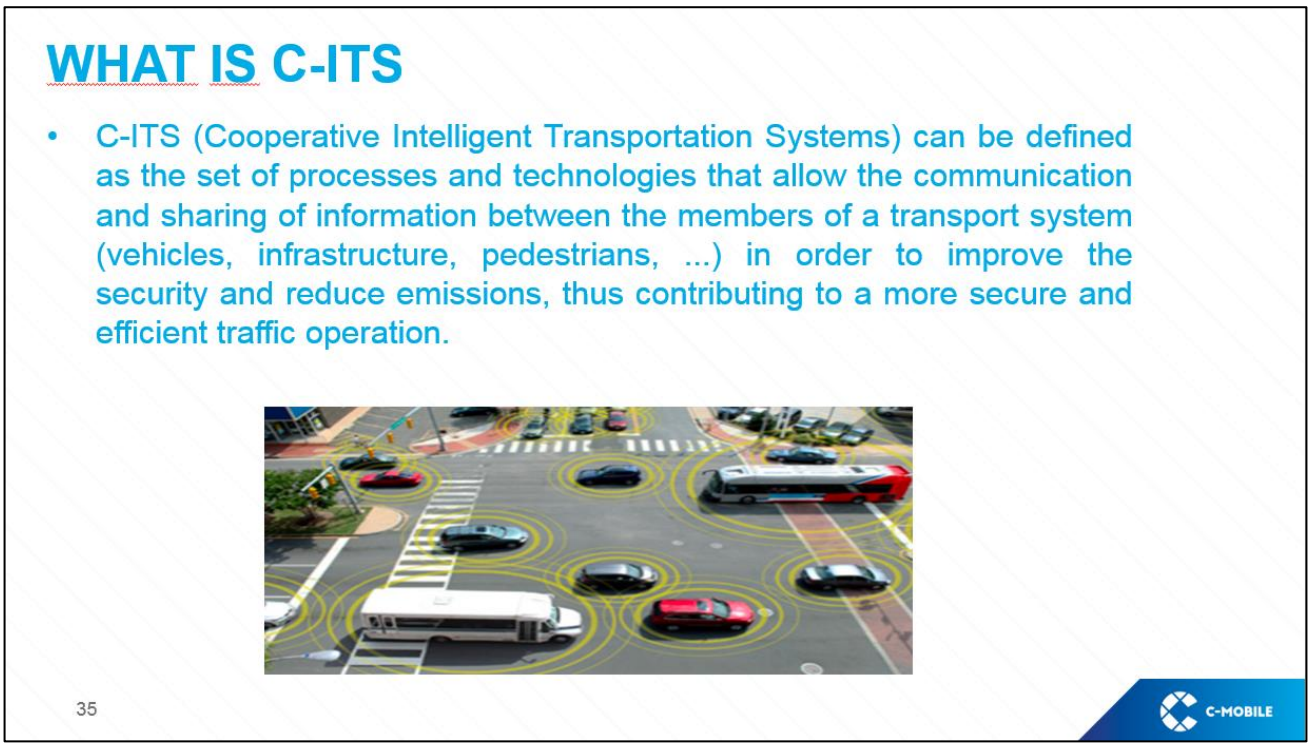


Figure 119: What is C-ITS?

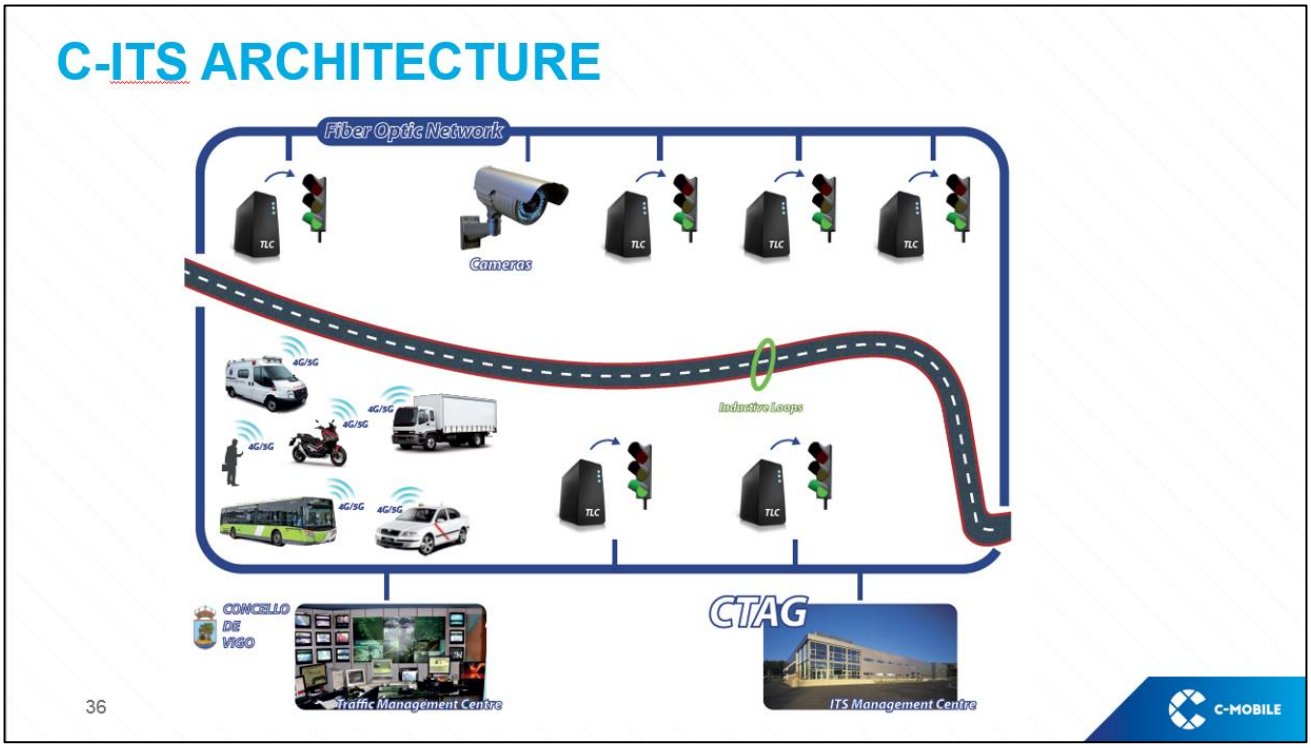


Figure 120: C-ITS architecture

C-ITS SERVICES

List of Day 1 services

Hazardous location notifications

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

Signage applications

- In-vehicle signage
- In-vehicle speed limits
- Signal violation / Intersection Safety
- Traffic signal priority request by designated vehicles
- GLOSA (Green Light Optimal Speed Advisory) / TTR-TTG (Time To Red-Time To Green)
- Probe vehicle data

C-MOBILE

Figure 121: C-ITS services

C-ITS SERVICES

List of Day 1'5 services

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

C-MOBILE

Figure 122: List of C-ITS services of Day 1.5

C-MOBILE

C-MOBILE C-ITS SERVICE

C-MobILE Applications Bundling	
Bundle 1: Urban efficiency	**Bundle 2: Infrastructure-to-vehicle safety**
Rest time management	Road works warning
Motorway parking availability	Road hazard warning (incl. traffic jams)
Urban Parking availability	Emergency Vehicle Warning
	Signal Violation Warning
	Warning system for pedestrian (not limited to crossings)
Bundle 3: Traffic efficiency	**Bundle 4: Vehicle-to-vehicle safety**
Green priority	Emergency Brake Light
Green light optimal speed advisory (GLOSA) / "Dynamic eco-driving" -> Time To red / Time To Green	Cooperative (Adaptive) cruise control (Urban ACC)
Cooperative traffic light for pedestrian	Slow or Stationary Vehicle Warning
Flexible infrastructure (HOV, peak-hour lanes)	Motorcycle approaching indication
In-vehicle signage (e.g. Dynamic speed limit)	(including other VRUs)
Mode & trip time advice (e.g. by incentives)	Blind spot detection / warning (VRUs)
Probe Vehicle Data	

C-MOBILE

Figure 123: C-MOBILE C-ITS services

ROAD WORKS WARNING

Background

Given the high number of incidents related to users accessing the works areas or impacting against the protection elements of the same causing victims (both users and operators), it is understood that the notice with sufficient notice of the existence of this type of events would prevent or at least significantly reduce the type of incidents discussed.

Purpose

Provide the user in advance with sufficient information about the existence of works (fixed or mobile) on the road and its possible impact on the conditions of the same (e.g. partial or total closure of one or more lanes).

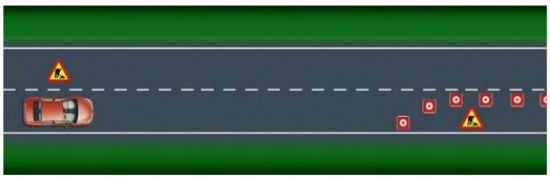
Desired behavior

- Increase attention.
- Adaptation of speed.
- Change of lane (if necessary).

Expected benefits

- Reduce the risk and number of accidents and dangerous situations for both users and operators.
- Inform users about the risk existing on the road.

Improve traffic management through the reduction of relevant events such as those indicated



C-MOBILE

Figure 124: Road Works Warning

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ROAD HAZARD WARNING

Background

Given the high number of incidents related to users suddenly encountering unexpected events on the road, it is understood that the notice sufficiently in advance of the existence of such events would prevent or at least significantly reduce the type of incidents discussed.

Purpose

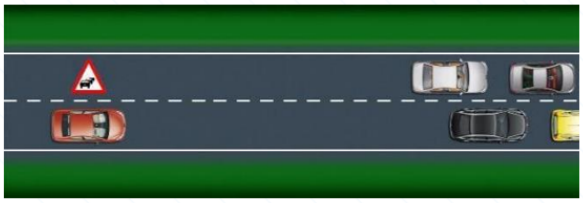
Provide the user with sufficient information in advance about those events that may involve some type of effect on the normal flow of traffic conditions.

Desired behavior

- Increase attention.
- Adaptation of speed.

Expected benefits

- Reduce the risk and number of accidents and dangerous locations for road users.
- Inform users about the risk existing on the road.
- Improve traffic management through the reduction of relevant events such as those indicated.



C-MOBILE

Figure 125: Road Hazard Warnings

EMERGENCY VEHICLE WARNING

Background

Given the limited capacity of reaction that often exists for users, especially in urban environments, before the "sudden" appearance of a vehicle circulating in emergency conditions in order to facilitate its passage, and situations of stress and nervousness that many times This situation implies, it is understood that the notice sufficiently in advance of the presence of this type of vehicle would prevent or at least significantly reduce the type of incidents derived from this type of situation, facilitating the safe passage of said vehicles.

Purpose

Provide the user with sufficient information in advance about the presence in their vicinity of a vehicle circulating in emergency conditions (e.g. police, fire, ambulance, ...)

Desired behavior

- Increase attention.
- Adaptation of speed.

Expected benefits

- Reduce the risk and number of accidents derived from existing traffic conditions.
- Faster and safer form of emergency corridors allowing to reduce the transit times of vehicles circulating in emergency conditions.

C-MOBILE

Figure 126: Emergency Vehicle Warning

C-MOBILE

SIGNAL VIOLATION WARNING

Background

Given that intersections are complex environments where, by mistake or omission, users may occasionally fail to comply with the existing regulation, notice of such circumstance means improving the security conditions in that environment.

Purpose

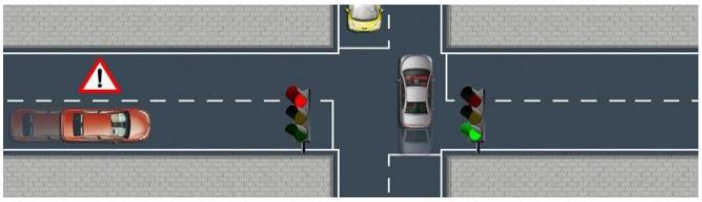
Provide the user with notice of an imminent violation (both their own and that of other users) of the existing regulation at the intersection to which they are approaching.

Desired behavior

- Reduction of the speed (until the total stopping of the vehicle) in order to avoid the possible collision.

Expected benefits

- Reduction of violations of existing regulation.
- Reduction in the number and degree of incidents generated.



C-MOBILE

Figure 127: Signal Violation Warning

WARNING SYSTEM FOR PEDESTRIAN

Background

Given the high number of incidents related to users being suddenly (for some or other movtivos) with pedestrians in the driving area, it is understood that the notice sufficiently in advance of their presence would prevent or at least significantly reduce the incidents previously commented.

Purpose

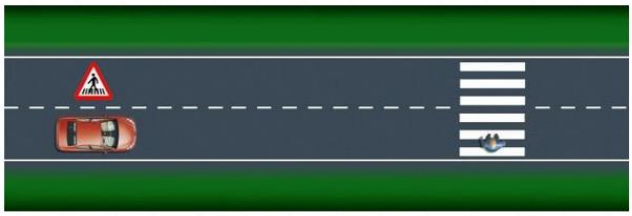
Provide the user in advance with sufficient information about the presence of pedestrians in their driving area.

Desired behaviour

- Increase attention.
- Adaptation of speed.

Expected benefits

- Reduce the risk and number of accidents and dangerous locations for road users.



C-MOBILE

Figure 128: Warning System for Pedestrian

TIME TO RED TIME TO GREEN

Background

Given that sudden variations in speed that, for one reason or another, occur at intersections adversely affect both environmental and driving safety conditions, it is understood that providing information on the existing traffic light regulation would help to improve the aforementioned aspects.

Purpose

Provide the user with information about the time remaining for the phase change of the semaphore to which he is approaching.

Desired behaviour

- Adaptation of the speed of approach to the intersection according to the information provided, thus minimizing sudden variations in speed.

Expected benefits

- Reduction of emissions
- Improvement of security levels.

C-MOBILE

Figure 129: Time to Red/Time to Green

IN VEHICLE SIGNAGE

Background

Due to the fact that, for one or other reasons, it is not always possible to visualize in an appropriate way the signage / information existing in the roadway, it is understood that providing this information "inside the vehicle", even in an enriched and / or adapted form , would suppose to improve the levels of existing security when reducing the levels of anxiety that the previous fact supposes.

Purpose

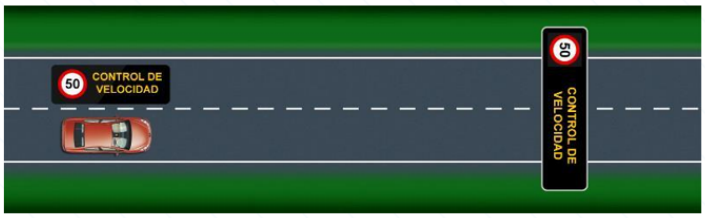
Provide the user "inside the vehicle" in an enriched and / or adapted way the signaling / information existing in the road

Desired behaviour

- Safe adaptation to the existing traffic regulations / conditions.

Expected benefits

- Improved traffic management due to the possibility of both providing information in a global (i.e. broadcast) and n only local (i.e. PMV) and to be able to do so enriched.
- Improvement of security levels through improved communication with users.
- Possible reduction of infrastructure equipment costs.



C-MOBILE

Figure 130: In Vehicle Signage

C-MOBILE

PROBE VEHICLE DATA

Background

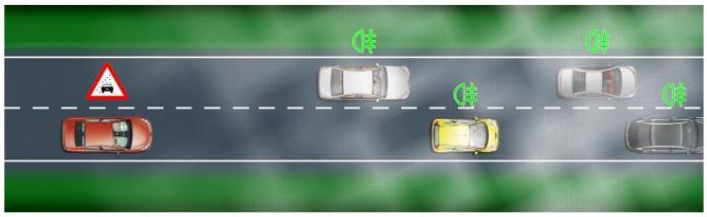
The need to have real-time knowledge of the conditions existing in such a dynamic and changing environment such as circulation, makes it necessary to find new sources of information beyond conventional ones (ie inspection of operators and security agents, sensors in the roads, ...) that facilitate the obtaining / updating of said conditions.

Purpose

Use vehicles as mobile "sensors" so that, through their information (e.g. speed, light status, ESP activation, ...), they allow to obtain / update information on existing traffic conditions.

Objective

- Provide traffic control and management centres with improved and updated information on existing traffic conditions.
- Expected benefits
- Improved security through more and more updated information on traffic conditions.
- Possible reduction of infrastructure equipment costs.



C-MOBILE

Figure 131: Probe Vehicle Data

SLOW OR STATIONARY VEHICLE WARNING

Background

Given the limited capacity of reaction that often exists for the user, before the "sudden" appearance of a vehicle circulating at abnormally slow speed or a damaged vehicle, it is understood that the notice sufficiently in advance of the presence of this type of vehicle would prevent or at least significantly reduce the type of incidents derived from this type of situations, facilitating the advancement in safety conditions of the same.

Purpose

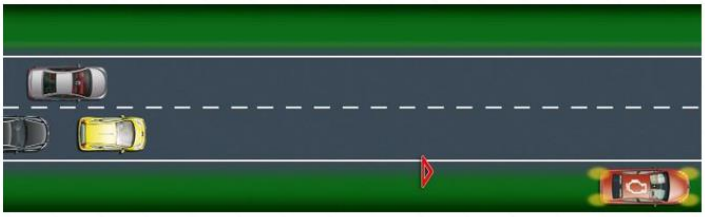
Provide the user in advance with sufficient information about the presence in their vicinity of a vehicle traveling at abnormally slow speed or a damaged vehicle.

Desired behaviour

- Increase attention.
- Adaptation of speed.

Expected benefits

Reduce the risk and number of accidents derived from existing traffic conditions.
Facilitate the advancement in safety conditions of this type of vehicle.



C-MOBILE

Figure 132: Slow or Stationary Vehicle Warning

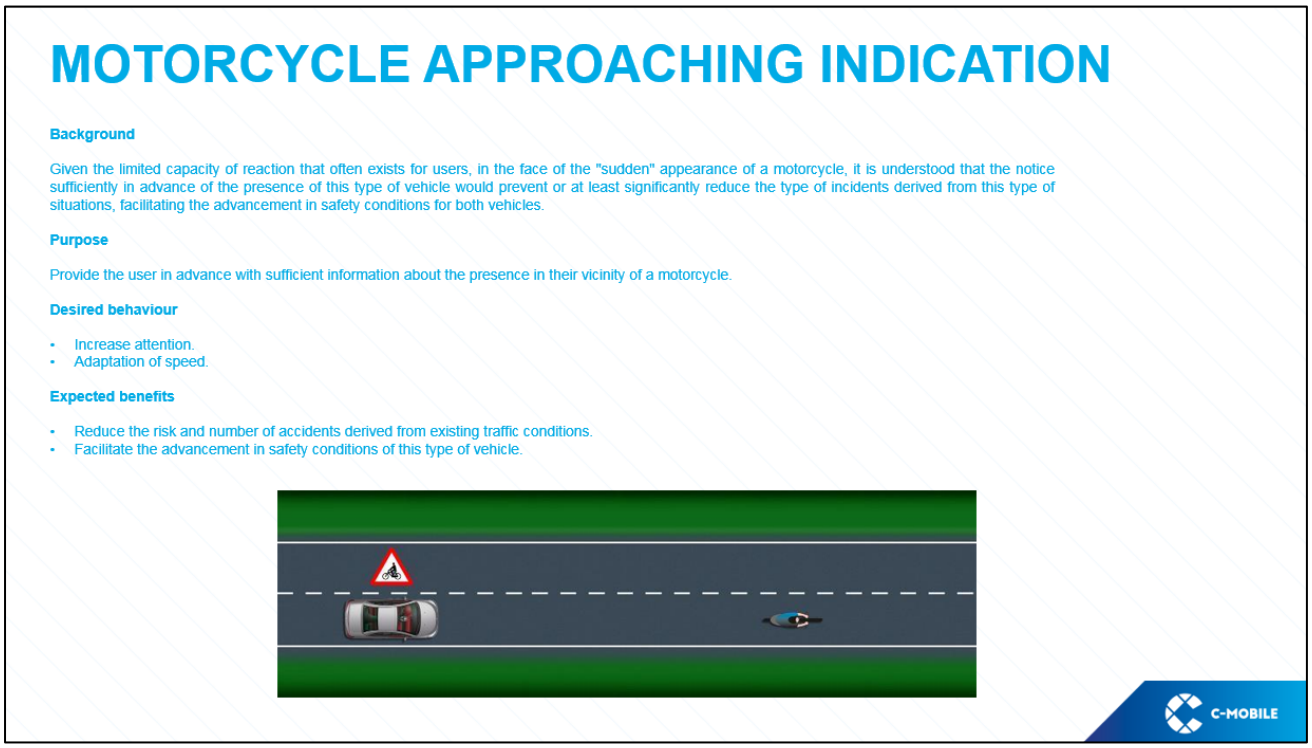


Figure 133: Motorcycle Approaching Indication

6.8.3. Practical module

6.8.3.1. Purpose of the module

Some services will be demonstrated based on a real situation to be tested by the participants, an also with videos recorded on real situations with explanations from a presenter. These modules will allow the participants to see directly how the theory explained in the previous section, is applied to the real environment and feel how the services work.

6.8.3.2. Description of covered materials

In this module tests based on a real situation will be done. Vehicle and infrastructure elements will take part in this section in order to make demonstrations of the use of services, information displayed to the user and the feeling of how the services affect the driving tasks.

7. Conclusions

This Deliverable 4.1 represents a collection of materials from local training activities on C-ITS services organised for professional drivers (trucks, buses, coaches and taxis) as well as fleet and traffic managers with the focus to raise the awareness and knowledge on use of deployed C-ITS technologies in all 8 DSs and related benefits. It also briefly describes the existing training methodologies and approaches currently used for providing trainings and ''blended" methodology that was used in providing C-MobILE trainings in all DSs. The key purpose of this collection of training materials is to be consulted and used by the DSs for later training of end-users not only in the C-MobILE project DSs, but also in other places of European Union where there is a need in promoting and increasing the knowledge on C-ITS services. This deliverable can also serve as an example of future planning of similar training activities as well as being used as a source of information on C-ITS technologies, deployment activities, challenges during installation of the services and approaches used for deployment the services.