Annual pilot overview report 2018

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Annual pilot overview report 2018

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France
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The Netherlands
Slovenia
United Kingdom
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Denmark
Finland
Hungary
Italy
Norway
Portugal
Sweden
Spain

1. Introduction

Core Members of the C-Roads platform are European States that agree to work together to achieve deployments that enable interoperable and seamless cross-border C-ITS services for European travellers. At the current stage sixteen European States committed to participate with their pilot sites. The C-Roads Platform remains open for other European States as well, as long as they are willing to actively participate.

The annual pilot overview report should give a summary of the pilot activities performed in each participating European States. This document describes on one hand the technical aspects as well as the budgetary situation.

Figure 1: C-Roads pilot sites

2. The Austrian Pilot site

The Austrian pilot contributes to interoperable European C-ITS solutions starting from the European C-ITS Corridor. The implementation is linked to the C-ITS Strategy Austria of the Ministry for Transport, Innovation and Technology - BMVIT, which defines the C-ITS deployment steps for the years till 2020 in an organisational framework, including the cooperation with public entities and industrial stakeholders.

The Austrian C-Roads-Pilot builds on the core elements of the European C-ITS Corridor project in Austria (ECo-AT) and extends them to a motorway based network of C-ITS stations in 2020, as defined in the Austrian C-ITS Strategy.

Since 2016, a pilot area ("Living Lab") around Vienna with 24 ITS-G5 Roadside ITS stations has been operational and open for stakeholders in 6 test cycles and cross border tests.

The tender for the ITS-G5 roll-out on the whole Austrian motorway network, including Day-1 and Day-2 use cases has been issued end of 2018.

There is a C-ITS Masterplan (till 2020) in place for a roll-out on the whole Austrian motorway network. This includes:

- A tender procedure for rolling out C-ITS infrastructure
- A proactive participation in standardisation bodies (ETSI, CEN/ISO)
- An adoption of specification also by international governments
- A deployment of the developed services on Austrian roads (Day 1 and selected Day 2 services)
- Common quality assurance
- Common development towards "Automated Driving"

Involved partners

- ASFINAG
- Kapsch TrafficCom
- Siemens
- Swarco

Locations
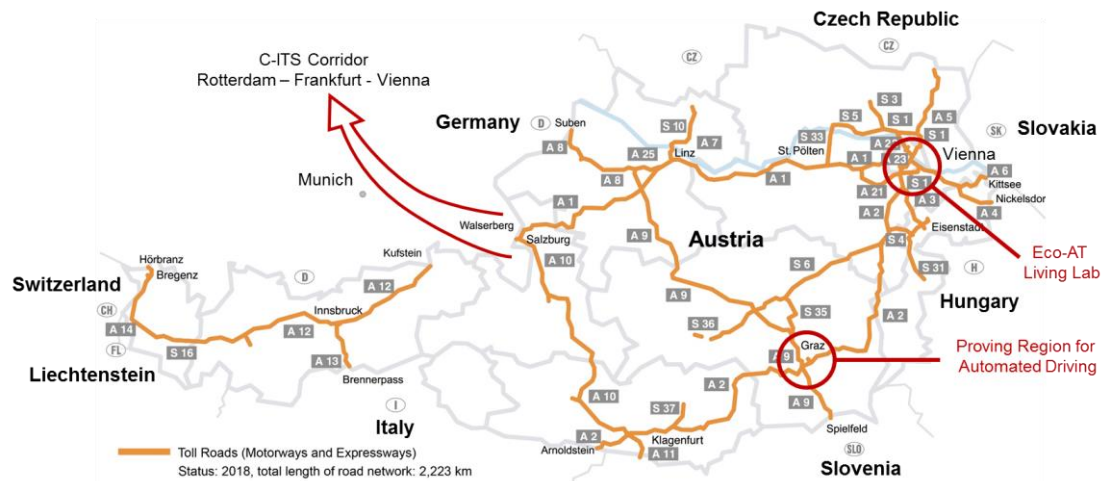
Figure 2: Map of the Austrian Roll-out
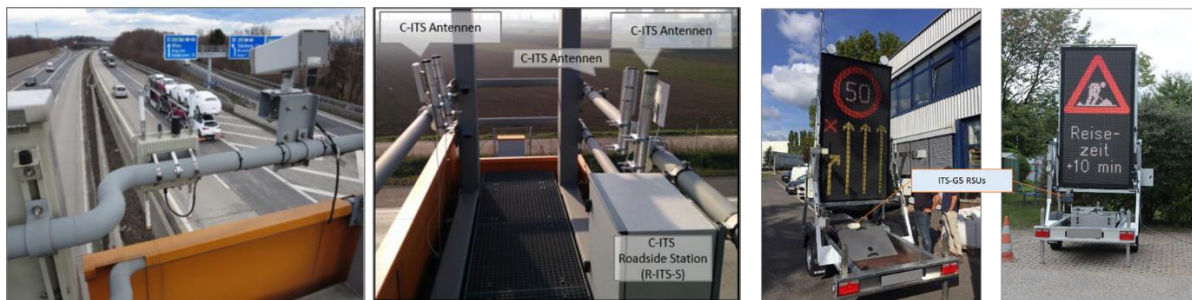
Figure 3: Existing ITS-G5 roadside equipment on Austrian motorways in Graz (left), Vienna (center), and safety trailers (right)

The Austrian C-Roads pilot covers several different areas of the motorway network:

- The motorways around Vienna, already in operation for the "Living Lab", will be updated to full deployment status.
- The motorways from Vienna to Salzburg (including Linz), a stretch of nearly 300km and the Austrian part of the C-ITS corridor between Netherlands, Germany and Austria, is an important C-ITS deployment area.
- The motorways around the city of Graz are part of the proving region for automated driving established in cooperation with the ALP.Lab consortium. Consequently, ITS-G5 roadside equipment has been installed and will be further extended.
- Further important locations are traffic hot spots and border areas, which are relevant for cross-border deployment.
- The roll-out starts from these deployment locations and extends them to the overall Austrian motorway network, which spans around 2200 km in total. The overall roll-out plan contains up to 525 fixed ITS-G5 roadside locations on the whole Austrian motorway network.

- Fixed roadside installations are complemented by mobile safety trailers equipped with ITS-G5. The first trailers of this kind have been available since 2017. A tender for a new ITS-G5 equipped trailers has been issued end of 2018.

Overview of progress by End of 2018

Selected Day-2 services have been identified and specified in a research cooperation with the Austrian C-ITS industry from end 2017 to mid 2018. The specifications have been published August 2018 as Extended Release 4.0 of the ECo-AT specifications, which is available on request via http://www.eco-at.info/Specification_request.html.

ITS-G5 roadside equipment has been installed and put into operation on the motorway around the city of Graz as part of the proving region for automated driving in cooperation with the ALP.Lab consortium and the INFRAMIX project.

The tender for ITS-G5-based C-ITS roll-out on the Austrian motorway network has been issued end of 2018. This tender includes both Day-1 and the aforementioned Day-2 services.
An additional tender for a new ITS-G5 equipped trailers has been issued end of 2018.

The following table gives an overview of the Day-2 services defined in ECo-AT Extended Release 4.0:

Use case / purpose	ITS service and message type	Status	References
Long Term Road Works Warning	In-Vehicle Information (IVIM)	Specified, Part of roll-out in Austria	CEN ISO/TS 19321
Automated Driving Support	Collective Perception Service / Cooperative Observation Service	ETSI Draft / Part of roll-out in Austria	ETSI TR 103 562 ETSI TS 103 324 ECo AT Extended Release 4
	In-Vehicle Information (IVIM) for automated driving	Part of roll-out in Austria	ECo-AT Extended Release 4, CEN ISO/TS 19321 (ext.)
Platooning Support	In-Vehicle Information (IVIM) for platooning	Part of roll-out in Austria	ECo-AT Extended Release 4, CEN ISO/TS 19321 (ext.)
Positioning Correction	GNSS Positioning Correction (GPC), Radio Technical Commission For Maritime Services Extended Message (RTCMEM)	Specified, Part of roll-out in Austria	ETSI TS 103 301 (Further options such as GNSS raw data message in ETSI EN 302 890-2)

The following figure gives an overview of the ITS channels used for safety-related Day-1 and Day-2 services:

ITS use cases

- Slow or Stationary Vehicle, Traffic Jam Ahead Warning (V2V)
- **Road Works Warning (I2V)**
- Weather Conditions (I2V, V2V)
- Emergency Vehicle Approaching (V2V)
- **Hazardous Location Notification (I2V, V2V)**
- **In-vehicle-signage /In-vehicle Speed Limits (I2V)**
- Signal Violation / Intersection safety (I2V)
- Green Light Optimal Speed Advisory (I2V)
- **Probe Vehicle Data (V2I)**

Automated Driving Support | Platooning Support* | Day-1 Services

Positioning Correction

Channel offload

Channels (EN 302 663)

| Service Channel 4 | Service Channel 3 | Service Channel 1 | Service Channel 2 | ITS-G5 Control Channel | Service Channel 5 | Service Channel 6 |

Non safety ITS | Safety-related ITS | ITS Extension

ITS

5855 MHz — 5875 MHz — 5905 MHz — 5925 MHz

I2V: Infrastructure to vehicle communication, V2V: Vehicle to vehicle communication
*Channel(s) for platooning support will be aligned with channels for V2V platooning messages

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
446,15	1.184,72	1.846,86	13.172,27	1.600

3. The Belgium (Flanders) Pilot site

The main objective of the C-Roads Flemish pilot is to operate and assess the deployment of a cloud based 'virtual infrastructure' for the effective deployment of C- ITS services connecting road users with the Traffic Management Centre (TMC) while allowing the TMC to directly interact with the end users. The pilot also will bring an opportunity to upgrade Traffic Information Services and Traffic Management Services as offered today.

At the test site existing cellular based 3G-4G/LTE mobile communication networks will be used in combination with the HERE Location Cloud and the local Traffic Management Centre, which should allow a group of approximately 1000 test drivers to receive and potentially update selected Safety Related Traffic Information (SRTI) using low latency data exchange, in line with the European Commission Delegated Regulation 886/2013 and the recommendations in the final report (phase I) of the EU C-ITS platform.

Involved partners

- Flemish Department of Mobility
- HERE
- ITS.be
- Tractebel Engineering

Location

Figure 4: Location of the Belgium (Flanders) pilot site

The pilot will cover all motorways part of the core network in Flanders, including R001, E313, E17/ E19, E34 and E40 that are part of TEN-T corridors. For evaluation purposes emphasis will be given to the E313/ E34 segments.

Overview of progress by End of 2018

The year 2018 brings a serious delay in the development of the different Use cases. First of all there was an internal reorganisation of the principal partner HERE, having serious impact on the staffing of the project.
On top of this we encountered serious underestimation on the system complexity necessary for some of the use cases.

The following use cases are developed on schedule and are ready for testing Q4-2018:
1. Stationary Vehicle
2. Accident Area
3. Obstacle on the road
4. Road Works
5. Slow Moving Vehicle
6. Slippery Road
7. Traffic Jam Ahead

The following Use cases will have a development delay of about 6 months and will be ready for testing Q2-2019:
8. Shockwave Damping
9. Reduced Visibility
10. Extreme Weather Condition
11. In-Vehicle Signage

Obviously this will have an impact on the planning of the rest of the project.
- The overall testing of the use cases is delayed by 3 months.
- So far we see a delay in the start of the pilot testing and the selection of the test pilots of about 3 months.
- The start of the evaluation will also be delayed.
- The end of the project will not be affected.

The data necessary for the evaluation is now agreed upon. Evaluation will start about 3 months later than scheduled, but the final report will be delivered in time.
A current status of the project and pilot was given at the Belgian ITS congress (11 October 2018). At that moment a wide audience of 580 mobility experts were informed about the upcoming tests. Also the first recruitment of test users started at the Belgian congress and at the World congress in Copenhagen.
The recruitment process of the 1000 test drivers is defined. Partly more professional users will be involved, partly a broader public will be addressed.

Main objectives for 2019 are:
Q1: end of development, evaluation system settled.
Q2: test with internal test drivers, technical validation
Q3: Start of pilot user fase with 1000 test users
Q4: first evaluation.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
20	560	1.670	1.680	540

4. The Czech Pilot site

Czech Republic has, in accordance to the project proposal, defined implementation and pilot testing of hybrid C-ITS services in six phases (further reported as DT – Deployment & Tests) split based on their geographical location and responsible implementation bodies. The DTs are the following:

- *DT0 – Is an existing C-ITS deployment project called "MIRUD - ITS corridor Mirošovice - Rudná" on the Prague bypass motorway (D0) connecting motorways D5 (Prague-Pilsen-direction Nürnberg) and D1 (Prague-Brno-direction Wien / Ostrava - Gdańsk) and small parts of D1 and D5 motorways near Prague. This deployment is being viewed as a base stone for future DT1 and DT3 deployments as the C-ITS back office has been developed for Road and Motorway Directorate (further stated as RSD). ITS G5 technology has been deployed for defined use cases supported by existing LTE services to increase coverage and accessibility of services.*

- **DT1 – Brno agglomeration**, RSD is responsible for ITS G5 deployment, and LTE-based services will be offered by the mobile phone operator O2 Czech Republic. C-ITS services will be deployed over hybrid ITS G5 / LTE system and the pilot will cover part of the D1 motorway along with selected major roads going to the city of Brno.

- **DT2 – Brno city**, Brnenske komunikace (BKOM) is responsible for deployment of ITS G5 technology, and LTE-based services will be offered by the mobile phone operators O2 and T-Mobile. C-ITS services will be independently provided via both ITS G5 / LTE system channels and the pilot will be deployed on urban roads, which will be selected complementarily to the major roads equipped by RSD within DT1.

- **DT3 – Motorways D1, D5, D11 and I/52 / D52**, RSD is responsible for ITS G5 technology deployment, LTE-based services will be offered by the mobile phone operators O2 and T-Mobile. New telecommunication services as LTE-V will be tested within this pilot operation. C-ITS services will be provided via hybrid ITS G5 / LTE (or/and LTE-V) technologies and the geographical area for this pilot will cover selected stretches of the D1, D5 and D11 motorways which create major connection links to the Dutch-German-Austrian C-ITS corridor.

- **DT4 – Public transport deployment in cities of Ostrava and Plzen,** The public transport company of Ostrava and public transport company of Plzen together with project partner INTENS are responsible for ITS G5 deployment, and LTE-based services will be offered by mobile phone operators O2 and T-Mobile. C-ITS services will be offered via hybrid ITS G5 / LTE system and the pilots will cover selected streets / sections of cities in order to demonstrate selected use cases.

- **DT5 – Railway crossing pilot,** Sprava zeleznicni dopravni cesty (Railway network operator - SŽDC) together with project partner AŽD Praha are responsible for ITS G5 deployment on railway level crossings while LTE-based services will be offered by mobile phone operator O2. C-ITS services will be independently offered via both ITS G5 / LTE channels and the pilot will be deployed at least on 2 level railway crossings. Both will be equipped with C-ITS systems where one crossing is equipped with a signalling system with both signal lights and barriers and the other is only with signal lights (without barriers).

- **DT6 – Cross border testing,** RSD is responsible for ITS G5 technology deployment, LTE-based services (along with LTE-V or/and LTE-B) will be offered by mobile phone operators O2 and T-Mobile. Within this DT interoperability of C-ITS services developed by C-ROADS CZ partners with other C-ROADS partners' systems will be tested.

Involved partners

The project coordinator is the Ministry of Transport of the Czech Republic. Following project partners are responsible for realization of this project:
- Deployment of C-ITS services via ITS G5
  - o Road and motorway Directorate (RSD) of the Czech Republic
  - o City of Brno (via. Brněnské komunikace)
  - o Správa Železniční Dopravní Cesty of the Czech Republic (SŽDC)
  - o City of Ostrava a Plzeň (via. their public transport companies)
  - o INTENS Corporation
  - o AŽD Praha
- Deployment of hybrid C-ITS system based on ITS G5 and current LTE technologies
  - o O2
  - o T-Mobile
  - o Škoda Auto
- Deployment of new cellular technologies (LTE-V and/or LTE-B)
  - o T-Mobile
- Evaluation and Assessment of implemented systems:
  - o Czech Technical University in Prague, Faculty of Transportation Sciences (CTU)

Location

The C-ROADS CZ pilot sites are located on:
- the Rhine-Danube Core Network Corridor, from Rozvadov at the Czech/German border to Praha
- the Orient-East Med Core Network Corridor, section Praha – Brno
- the urban nodes Plzeň, Brno and Ostrava. Plzeň and Ostrava are situated on the Rhine-Danube Core Network Corridor. Ostrava and Brno are situated on the Baltic-Adriatic Core Network Corridor
- Railway crossings are located in the Pardubice region and there is an option under consideration to widen the deployment also to the Usti nad Labem region.

The deployment of C-ITS system and services will be carried out at least on the following parts of the Czech road network split into individual DT´s:

- **DT1 Brno agglomeration** will cover southern sector of the city of Brno, in particular the following roads / motorways:
  - o Part of motorway D1 (E50/E65) in approx. length of 28 km between km 182 and km 210
  - o Major radial roads (capacity roads connecting the outer ring road to the city center) in the southern sector of the city of Brno
    - ▪ EXIT 190 (road I/23 direction to Pisárecký tunnel)
    - ▪ EXIT 194 (road I/52 / motorway D52 direction to Vienna (Austria) and direction towards city Brno centre)
    - ▪ EXIT 196 (motorway D2 direction towards Bratislava (Slovakia) and towards city Brno centre (I/41))
    - ▪ EXIT 203 (road I/50 direction towards city Brno centre).
  - o Southern part of inner city ring road consisting of the I/42 road

- **DT2 Brno city,** this pilot will take place on the 1st class radial roads connecting the city centre and outer ring road of Brno (motorway D1), as well as on the Brno inner ring road. This DT will be closely coordinated with DT1 in order to supplement RSU installations on the major city roads. Additionally lower class roads will be investigated to be equipped by

RSUs in case they create an important alternative route to the major roads.

- **DT3 – Motorways D1, D5, D11 and I/52 / D52** C-ITS equipment and services will be deployed on the D1 motorway between Prague and Brno, D5 motorway between Prague and Rozvadov (German border), on the D11 motorway between Prague and Hradec Králové, and on the D52/I52 connection road between Brno and the Austrian border. Total length amounts to more than 360 km. This pilot site includes both cross-border locations – on the D5 motorway with Germany, and on the D52/I52 motorway/road with Austria.

    o Motorway D1 (E50/E65) between Prague and Brno, where ITS-G5 technology will be deployed around the Brno agglomeration and cellular technology will be used for C-ITS services coverage on the remaining part of the motorway.
    o Motorway D5 (E50) between Prague and the German border, where ITS-G5 technology will be deployed on the section between Prague and Plzeň (km 6 – km 90) and cellular technology will be used for C-ITS services coverage on remaining part of the motorway.
    o Motorway D11 (E67) between Prague and Hradec Králové (km 0 – km 90), where ITS-G5 technology will cover whole motorway section and cellular technology will be used as a secondary communication tool for C-ITS service provision.
    o Combined motorway D52 and 1st class road I52 (E461) from Brno to the Austrian border will be covered by cellular technology to provide C-ITS services.

- **DT4 – Public transport deployment in cities of Plzen and Ostrava** will be performed in existing city streets/roads and intersections with tram rail infrastructure. Suitable junctions equipped with traffic lights will be selected for public transport priority use case as well as "dangerous" locations for passengers or critical collision points between public and individual transports will be identified for deployment of safety related applications.

- **DT5 – Railway crossing pilot** will be performed on the Heřmanův Městec – Moravany railway line, the section of Chrudim – Hrochův Týnec in the Pardubice region, where ITS-G5 will be deployed at two railway level crossing equipped with conventional signalling systems (one with- and one without barriers). One more site is being considered for additional two other level crossings depending on approval by INEA.

- **DT6 – Cross border testing,** will be situated mainly on the D5-A6 motorway (Czech - German border) and the I/57 – E59 road (Czech - Austrian border), but other C-ROADS CZ test sites may be selected as well. All C-ROADS Platform partners will be invited to the testing.
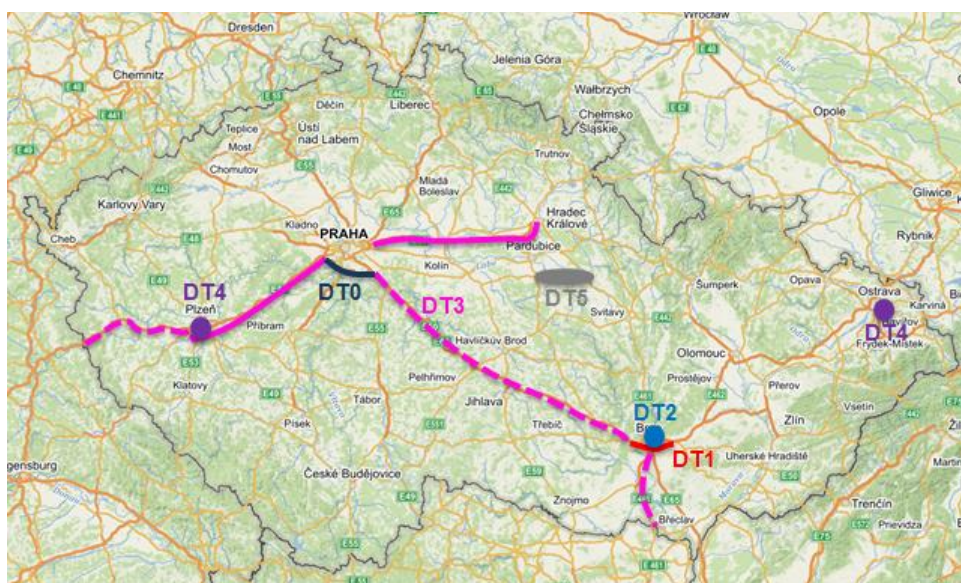
Figure 5: Location of the Czech pilot site

Overview of progress by End of 2018

In 2018 new C-ROADS CZ System Specifications Release 1.5 have been published. This release, compared to the previous release 1.0, further describes C-ITS system in order to ensure national and cross-border interoperability, and thus follows the recent development in the C-Roads Platform's specifications (e.g. communication profiles, security). However, some aspects, like hybrid communication, are still not part of this release, since they have not been agreed on the C-Roads Platform level yet. In 2018 also the new release (1.5) of the C-ROADS CZ Use Case Catalogue has been published in order to reflect the recent changes in the C-Roads Platform specifications (TF2 and TF3 documents). These documents are now used by the project partners and their subcontractors in order to implement their C-ITS systems according to the common agreed system specifications.

As regards preparatory works for deployment of C-ITS system and services on defined Czech pilot sites, three public tenders for key pilot sites (DT1, DT2, DT3) were successfully finished and the contracts were signed with technology providers. That allowed the project to proceed to the next step of starting C-ITS system deployment. As for each Czech pilot sites:

DT1 Brno agglomeration – RSD signed the contract for C-ITS deployment in November 2018. First phase of the project was implemented in December 2018 (RSUs at the selected parts of D1 motorway and OBUs in two RSD vehicles). According to the contract provisions, Phase 2 starts after the period of winter maintenance is finished (according to the regulations the determined period is 1.11.2018 – 31.3.2019). Expected completion date of DT1 deployment is August 2019.

DT2 Brno city – BKOM chose provider of technology in October 2018 and C-ITS deployment has started. The system will be handed over to BKOM by the end of April 2019 based on individual tests. This will result in the completion of Stage 1 and the execution of comprehensive tests of the delivered system will begin within Stage 2. This stage ends by signing of the acceptance protocol and the last stage 3 will begin. During this stage, tests within the C-ROADS CZ project will be carried out.

DT3 – Motorways D1, D5, D11 and First-Class Road no. 52 / D52 – RSD has started implementing C-ITS system since September 2018. Phase 1 of the project was finished in December 2018 (RSUs at the selected parts of D5 and D11 motorways and OBUs in two RSD vehicles). According to the contract provisions, Phase 2 starts after the period of winter

maintenance is finished (according to the regulations, the determined period is 1.11.2018 – 31.3.2019). It is expected that the whole C-ITS system will be completely put in operation in September 2019.

DT4 – Public transport deployment in cities of Pilsen (Plzeň) and Ostrava – Intens installed RSUs in cities of Pilsen (1 RSU) and Ostrava (5 RSUs). Moreover, one OBU has been deployed to public transport vehicle (bus) in Ostrava. Installation of OBU to tram vehicles will be performed in April 2019.

DT5 – Railway crossing pilot – SŽDC and AŽD Praha have also started implementing C-ITS systems on 2 railway level crossings in 2018 (1 RLX equipped with both signal lights and barriers, 1 RLX equipped only with signal lights (without barriers). SŽDC together with AŽD Praha are responsible for ITS G5 deployment on RLX while LTE-based services will be provided by mobile phone operator O2. Deployment of the two selected railway crossings is expected to be completed in May 2019. Moreover, deployment of C-ITS systems on two additional railway crossings was proposed in 2018 and it is being evaluated/assessed by INEA. The respective Back-office is ready for testing in lab and later in 2019 will be deployed at SZDC dispatcher centre with a back-up at AŽD Praha lab.

With regard to other involved partners, O2 has successfully implemented the Back-office, mobile application, integration platform and security layer. O2 has also started LTE network measuring and creating hybrid OBU. T-Mobile has started implementing LTE-V technology on the testing sites, implementing of Back-office and developing and testing new functionalities for end-users of tablets and smartphones using data from C-ITS sources.
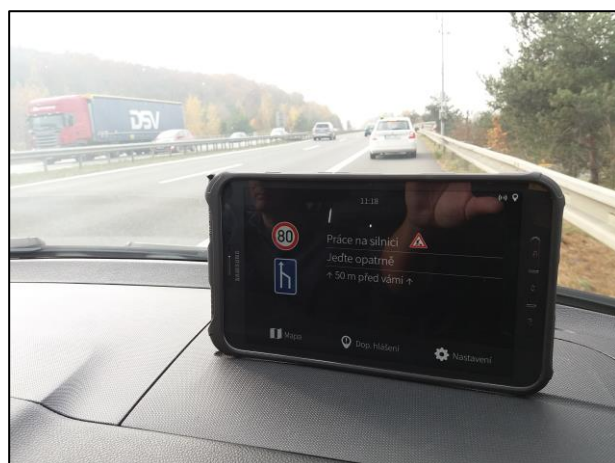

Figure 6: Czech pilot site

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
128,61	829,63	1.970,27	10.679,30	2.170,12

5. The French Pilot site

C-Roads France is a pilot project whose objective is to develop and experiment innovative road C-ITS solutions. C-Roads France will push for the early adoption of flexible, interoperable and scalable C-ITS solutions, anticipating the commercialisation of equipped vehicles.
C-Roads France will develop 2 types of new end-user services: services in the urban environment and at the urban/interurban interface, and traffic information services increasing comfort on transit stretches. Hence, it will provide a consistent solution for the deployment of almost all Day-1 services and of some Day-1,5 services as defined by the EC C-ITS Platform.

The Action aims to reach a seamless continuity of services at the urban/interurban interface. It will provide enhanced and extended test fields including strategic sections of the TEN-T Core Network, key bottlenecks, black spots and interfaces with urban nodes, to reach a critical mass. The action is supported by 2 car manufacturers to maximise interoperability with the infrastructure and ensure future roll-out of vehicles.

C-Roads France advocates for a pragmatic and user-centric approach: the Action will develop a C-ITS smartphone application supporting early I2V (infrastructure-to-vehicle) services roll up and further scale up. The services will be supported by a hybrid technology enabling a seamless switch between ITS G5 and cellular for not safety-critical applications.

C-Roads France builds on the results of SCOOP@F.

Involved partners

ROAD OPERATORS	– Ministry: public road operators (DIRs Est, Centre-Est, Atlantique, Ouest) – ASFA: concessionaries road operators (APRR, SANEF and VINCI Autoroutes)
MAJOR URBAN NODES	– Strasbourg Eurométropole – Bordeaux Métropole
CAR MANUFACTURERS	– Renault – PSA
RESEARCH INSTITUTES	– CEREMA – IFSTTAR
UNIVERSITIES AND HIGHER EDUCATION AND RESEARCH INSTITUTIONS	– Université d'Auvergne Clermont-Ferrand – Université de Reims Champagne-Ardennes – Institut Mines Télécom (Telecom ParisTech)
SECURITY EXPERTS	– IDnomic
MOBILITY LABS	– Car2road – Transpolis

Location

The action will be implemented on 4 local pilot sites combining TEN-T network and urban sections.
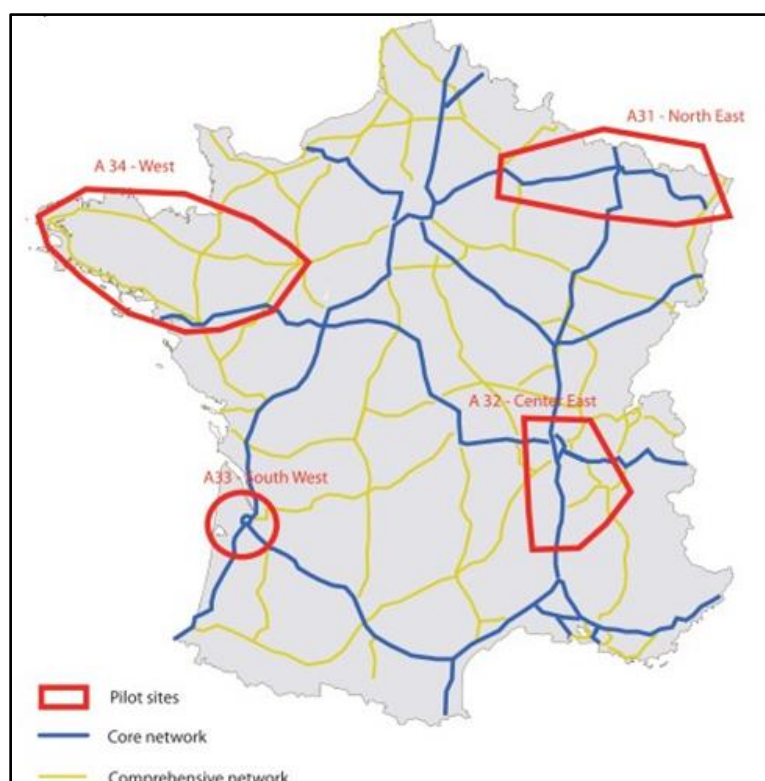
Figure 7**: Location of the French pilot sites**

Overview of progress by End of 2018

French Pilot sites have defined and prioritized the services to deploy. They have also determined where to deploy them.

All road operators and car manufacturers have finished their tendering process and their providers have started work on developments, based on specifications issued by the Studies Activity. Developments will allow to deliver the C-Roads France prototypes on all components of the C-ITS chain on the French architecture: from On-Board Units (OBU) in vehicles and Road-Side Units (RSU) to the Traffic Management Systems, and the central national C-ITS station. This work includes the security protocols (PKI) and is done in hybrid technology (ITS-G5 and cellular).

Road operators have launched studies to determine exact location of RSU depending on use cases and infrastructure characteristics, and the most advanced ones have already deployed a few RSUs.

Road operators took the lead on the smartphone application specification activities. They worked on the global and technical architecture and on the main principles that will allow smartphones to communicate with the C-ITS ecosystem. They also developed a Proof of Concept to validate technical choices. A call for tenders has been launched to develop this smartphone app.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
716,48	279,69	266,75	3.527,22	1.673,62

6. The German (Hessia, Lower Saxony) Pilot site

Germany as Member State will contribute to the C-Roads cooperation by the findings of the implementation and operation of in total seven different C-ITS services, which will be deployed in two different pilot sites and harmonised by the Federal Highway Research Institute (BASt).

The national action promotes an ideal manner for the future rollout/larger scale deployment of Cooperative ITS in whole Germany by deploying additional new and extending already existing C-ITS services, respectively. Following goals should be achieved in this project:

- provision of a deployment pattern for a rollout of these C-ITS services in Germany according to EU regulations and standards and in line with the recommendations/outputs of the "C-ITS platform"
- demonstration of long-term viability and scalability of C-ITS (in terms of technology, financial sustainability, governance) as well as in conjunction with legacy systems
- encouragement of the German automotive industry to equip their cars with appropriate devices and thus stimulation of end-users to buy V2X-enabled cars to benefit from the services

To achieve these goals, the mentioned services in the Hessen and Niedersachsen pilot road network will not only be deployed, but also delivered as a transferable C-ITS framework, harmonised on European level in cooperation with other pilot sites in the frame of the C-Roads Platform. This comprises:

- an **organisational pattern** (roles and responsibilities) for the development and deployment
- a **work program** for the development of needed infrastructure and equipment including open technical specifications and standards
- **appropriate methods and KPI** for the evaluation and assessment of the deployed C-ITS services

The C-ITS Pilot Hessen will contribute to the C-Roads cooperation by implementing and deploying the following C-ITS services:

- Road Works Warning Service Deployment (RWW) (extension of the existing service for long-term roadworks)
- Maintenance Vehicle Warning (MVW) [former Slow or Stationary Vehicle Warning Service Deployment, SSVW)]
- Emergency Vehicle Approaching Service Deployment (EVA) [former Slow or Stationary Vehicle Warning Service Deployment, SSVW)]
- Traffic Jam Ahead Warning Service Deployment (TJW)
- Shockwave Damping Service Deployment (SWD)
- Green Light Optimal Speed Advisory Service Deployment (GLOSA)
- Probe Vehicle Data (PVD) Service Deployment (extension of the existing version to support the services TJW and SWD)

The Niedersachsen C-ITS Pilot will contribute to the C-Roads cooperation by implementing and deploying the following three C-ITS services:

- Maintenance Vehicle Warning (MVW) [former Slow or Stationary Vehicle Warning Service Deployment, SSVW)]
- In-Vehicle Information/In-Vehicle Signage Service Deployment (IVI/IVS)
- Probe Vehicle Data Service Deployment (PVD)

Involved partners

Pilot activities at single test and validation locations are prepared by different bodies. The Hessian pilot site will be organised by the local public road operator Hessen Mobil. For the Niedersachsen pilot site the two companies NORDSYS and OECON Products & Services, which will be supported by the associated partner Deutsches Zentrum für Luft- und Raumfahrt (DLR), are responsible for the local activities.

Full list of consortium members:
- ITS mobility GmbH (former ITS automotive nord GmbH)
- Federal Highway Research Institute (BASt)
- Hessen Mobil – Straßen- und Verkehrsmanagement
- Continental Teves AG & Co. oHG
- SWARCO Traffic Systems GmbH
- AVT STOYE GmbH
- GEVAS software GmbH
- Heusch/Boesefeldt GmbH
- Bayerische Medien Technik GmbH
- Hessen Digital Radio GmbH
- Garmin Würzburg GmbH
- NORDSYS GmbH
- ESCRYPT GmbH – Embedded Security
- INGENIEURGESELLSCHAFT FUER AUTO UND VERKEHR GMBH
- e-Shuttle GmbH
- Niedersächsisches Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung
- OECON Products & Services GmbH

Location

The seven so called Day 1 Services are trialled in the German testbeds in Niedersachsen (motorway A2 near Brunswick, see figure 8 and Hessen DRIVE-test field Hessen for connected automated traffic around Frankfurt, see figure 9 and figure 10).

In Niedersachsen, the currently existing R&D test area "Application Platform for Intelligent Mobility (Anwendungsplattform Intelligente Mobilität, AIM))" focuses on the urban area in the city of Brunswick and serves as a platform for application-focused science, research and development in the field of intelligent mobility services. Within this year the test field will be enlarged and transferred under the lead of the Ministry for Economy, Labour, Transport and Digitalisation of the Federal State of Niedersachsen (Niedersächsisches Ministerium für Wirtschaft, Arbeit, Verkehr und Digitalisierung, MW) and the German Aerospace Centre (Deutsches Zentrum für Luft- und Raumfahrt, DLR) to federal roads and motorways between Hannover, Brunswick and Wolfsburg. On the motorways (especially on the A2) of this new Test Site Niedersachsen amongst others it is planned to extend existing gantries with ITS Road Side stations (R-ITS-S) to provide C-ITS services for testing and development activities via ITS G5.
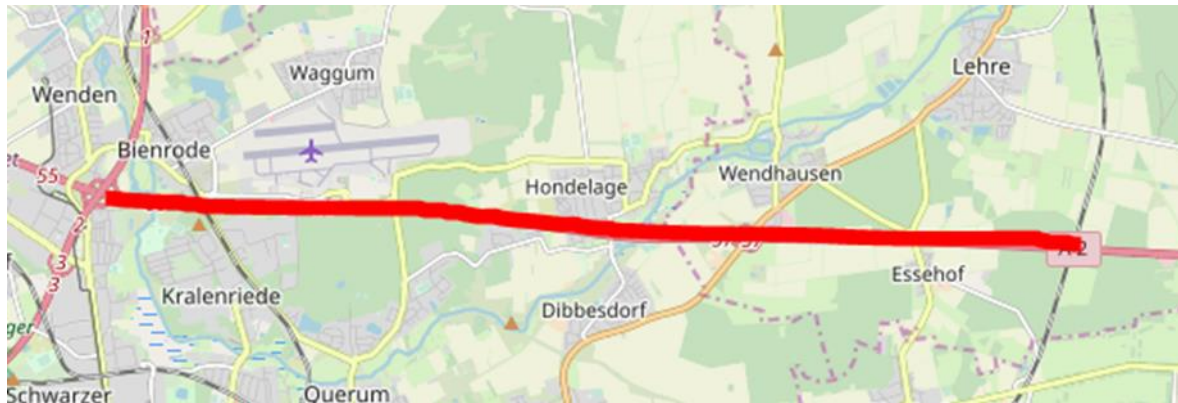
Figure 8: Niedersachsen pilot site stretch[1]

The activities of the Hessen Pilot will be realised on the following motorway sections:

- A3 around Offenbach, Frankfurt and the airport in Frankfurt to Mönchhof-Dreieck
- A5 in the whole area between central Hessen (Wetterau) and the South Hessian state border including Frankfurt and Darmstadt
- A60, A67 and A671 in the whole Hessian area
- sections of the A661 near Frankfurt
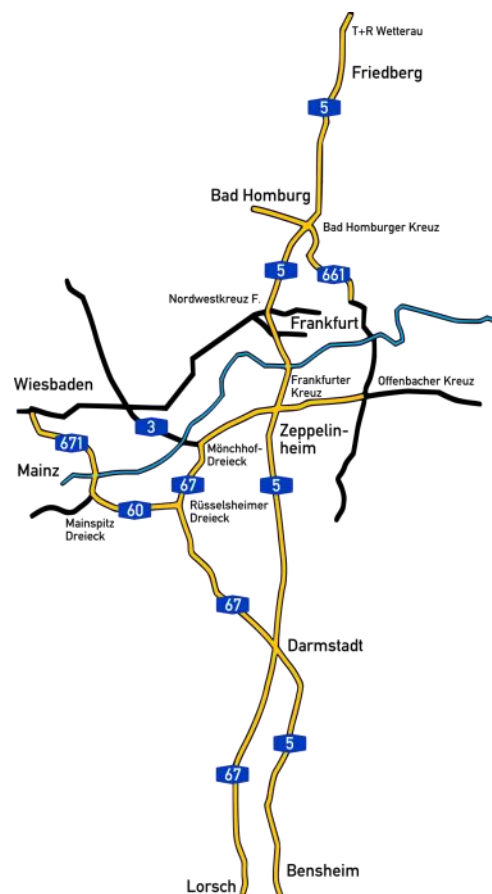
Figure 9: Overview of the test field of the C-ITS Pilot Hessen

Furthermore, the GLOSA service will be implemented on national roads in a city in the Rhine-Main region.

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[1] source of the map: © OpenStreetMap
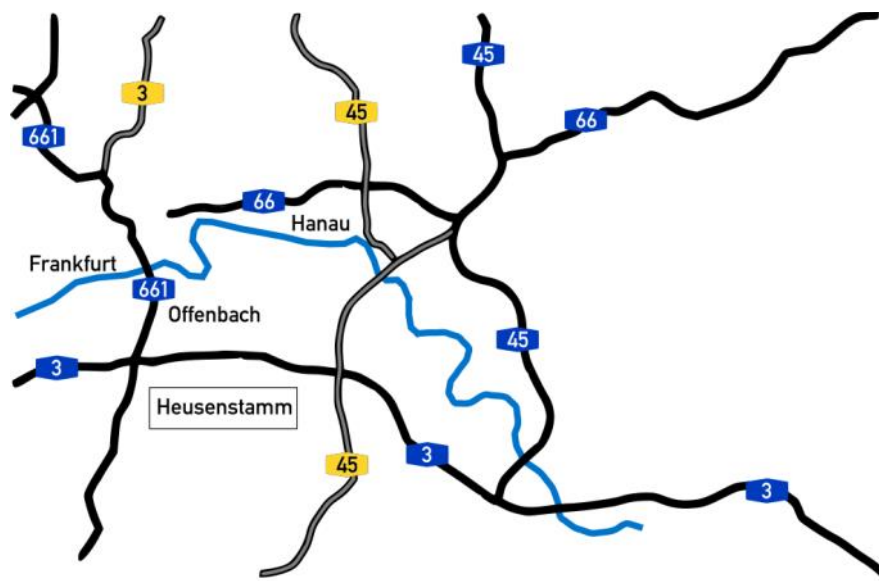
Figure 10: Test area of the GLOSA service in Hessen

Overview of progress by End of 2018

C-Roads Platform has established solid structures for harmonisation of C-ITS specifications and alignment of C-ITS deployment across Europe. In parallel to that, C-Roads Germany has built up the corresponding structures for aligning the German C-ITS pilot sites. The start-up difficulties (project-internally and within the C-Roads Platform) have been overcome and the work has become routine. The actual resource consumption of C-Roads Germany is still slightly below the original target figures, but the consolidated structures permit a more intensive goal-orientated engagement and full use of the budget in the remaining project duration now.

All activities are largely on track as scheduled so far. First implementation actions were started in 2017. In Hessen (Activity 3), the system architecture, the services itself as well as the R-ITS-S and V-ITS-S were specified. RWW, PVD and MVW services have been deployed successfully in 2018 and are operational since 2019 (MS 43).

In Niedersachsen, the cooperation with the relevant state authorities was successfully initiated (Activity 4). Implementation and verification of the MVW service will be postponed in the beginning of 2019. The IVS activities went as scheduled. The planned activity of the PVD service for the end of 2018 will be postponed until the beginning of 2019. The use cases still have to be specified. In essence, all milestones have been reached.

The harmonisation of the German activities (Activity 2) within the C-Roads Germany Coordination Group and the established Expert Groups was set in place at the technical meeting in 2017. The groups have been continuously refined and consolidated. In 2018, two Steering Committee meetings took place to discuss results and urgent topics. A test-concept for the technical and functional evaluation of the services has been developed which includes a determination of the required test level and test criteria, a distribution matrix of the responsibilities concerning the activities (service spec, test case specification and testing) and templates for the necessary test cases of each service. The service-related details are located in the annexes of the document that will be updated according to the deployment process of the CRG services. The development of an impact assessment plan has been discussed, too.

Cooperation and detailed work on the C-Roads Platform (Activity 1) on organisational issues, technical specifications and evaluation/assessment have also been continuously developed and actively supported by C-Roads Germany. The C-Roads Germany members were involved in specifying the Releases 1.3 and 1.4 in 2018.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
724,9	1.492,6	2.091,6	2.876,6	2.426,3

7. The Dutch Pilot site

The Dutch pilot area is situated in the south of the Netherlands. The area consists of the TEN-T Core Network road section from Europoort Rotterdam to the Belgian border, A15 A16 and the motorway section from the Belgian border via Eindhoven to Venlo, A67. To connect these two Core network sections and have a meaning full ongoing corridor to roll out the proposed services, the road section Breda to Eindhoven (A58, A2) of the comprehensive network, has been added because of the major C-ITS developments which takes place there. Next to that also the Core network section on the A2 around the Leidsche Rijn Tunnel is added. The total network stretches out for 268km of which 60km or 22% is comprehensive network. Next to these road sections the port of Rotterdam, industrial and logistic area makes part of the Dutch corridor. Also the Moerdijk industrial area and the Venlo Trade Port are included. Both Rotterdam and Moerdijk are seaports on the core network. Venlo Trade Port is a multimodal platform on the CEF Corridor North Sea Mediterranean. To strengthen the corridor A58 and A67 in the Province of Noord Brabant, budgets have been allocated for innovative solutions. To improve the accessibility of the region "Smart Mobility" solutions will be piloted and implemented. Combining the Brabant Corridor initiatives with the services proposed within the InterCor project, the region will benefit even more.

Involved partners

The project coordinator is Rijkswaterstaat, a part of the Dutch Ministry of Infrastructure and Water management. Furthermore the Province of Noord-Brabant and the Province of Utrecht are involved.

Location

The services will be piloted along the Dutch part of the Rhine-Alpine corridor, formed by the Dutch motorways A67, A2, A58, A16 and A15 as well as along the A2 in the area of the city of Utrecht.
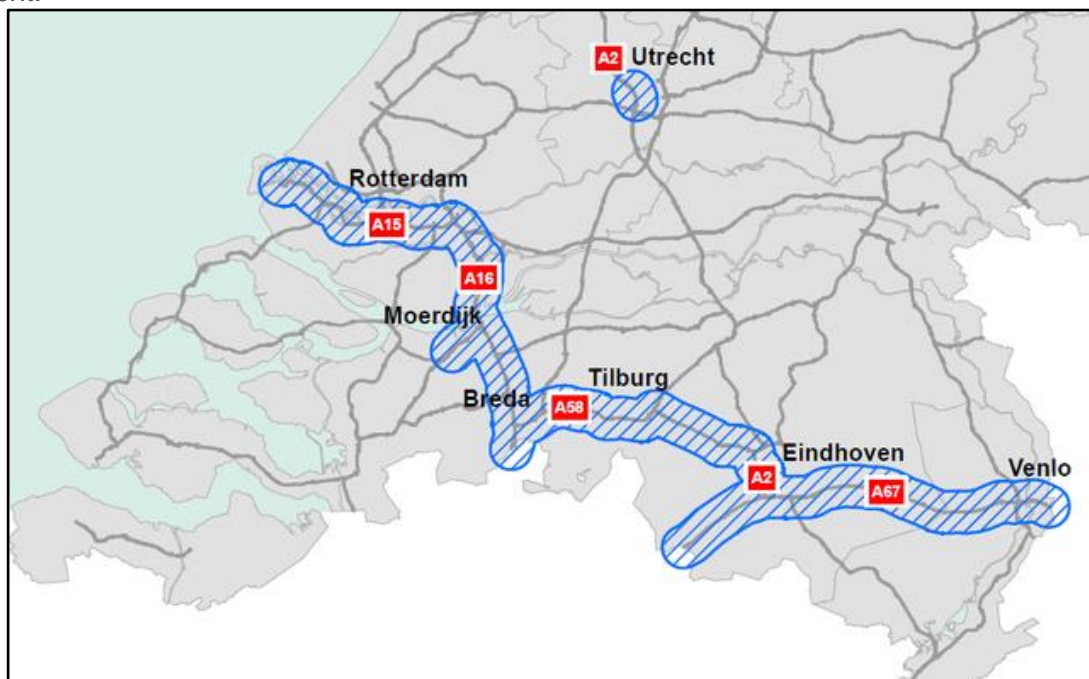

Figure 11: Location of the Dutch pilot site

Overview of progress by End of 2018

In the Netherlands an incremental approach was chosen for the InterCor pilots, building on work already carried out in the Cooperative ITS Corridor project and other (national) projects such as Talking Traffic. The pilot activities can be seen as a process growing from first trials with ITS-G5 communication in 2016 to full pilot operation with all services with cellular and ITS-G5 communication running in 2018/2019. This incremental approach not only allowed for extra services gradually being added over time, but also allowed adapting to changes of the (international) specifications of systems in the first years of the InterCor project and to work in a 'learning by doing' way.

In 2016 first activities on the road started, regarding RWW (trailer based portable solution) and PVD with ITS-G5 communication. In March 2017 this was followed by first trials with RWW and IVS (fixed roadside units) on motorway A16 south of Rotterdam. Later on PKI was added as well as the hybrid approach including cellular communication. Taking into account the experience from the first activities, the A16 test site was extended, in order to be able to organise the first interoperability TESTFEST on services, using ITS-G5 communication (RWW, IVS and PVD) in July 2017. Subsequent TESTFESTs led to further adaptions of the test-site.

The GLOSA test site in Helmond was operational in a first phase from the beginning of 2018. At this stage, the GLOSA service in Helmond has been provided to 50 trucks and emergency vehicles making use of ETSI ITS-G5 messages. From January 2019 a new baseline will be rolled out to ensure interoperability with the InterCor profile standard for SPaT and MAP and realising compatibility with the Dutch Talking Traffic iVRI specifications. In addition to the ETSI ITS-G5 messages, the GLOSA service will be also delivered fully hybrid.

Several cellular services have been added to the Dutch pilot activities in 2018 and at the start of 2019: RWW and IVS in summer of 2018, MCTO as of September 2018, the Truck Parking and Tunnel logistics as of February 2019.

In 2018 the PKI TESTFEST (Reims, FR), the GLOSA pre-hybrid (Helmond, NL) and the hybrid TESTFEST (Chatham/London, UK) took place. At the time of the Service TESTFEST (25-28 March 2019, Antwerp, BE) all four Member States will have their pilot sites ready and pilot operations running (or about to begin), using the specifications from sub-activity 2.1 (ITS-G5, hybrid, PKI and C-ITS services). This allows InterCor to broaden the original scope of the Service TESTFEST. The original plan was to test the C-ITS services specifications (as a result of this work item in sub-activity 2.1) in a TESTFEST to take place in only one of the four Member States. With the shifted timelines all pilot site implementations are available in the four Member States, with the final specifications implemented. Therefore the final TESTFEST will be a cross-border event, with vehicle implementations from all four Member States, validating not only the interoperability of the C-ITS services, but also the ITS-G5, hybrid and PKI implementations in the different Member States. This approach provides not only input to Activity 2 but also to Activity 4, confirming that the technical implementations of the pilots, generating the evaluation results, are indeed according to the agreed specifications.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
1.100	3.700	5.200	3.300	

8. The Slovenian Pilot site

The objective of the "The C-Roads Slovenia" pilot is to improve real time traffic information on pilot section and to test C-ITS hybrid communication solutions for C-ITS day 1 services related to motorways.

Goal of the activity is to supplement or complete critical road sections and systems with C-ITS ready roadside ITS equipment with the integration of deployed systems in TMC Centres as real time services for the higher level of traffic control and management that will correlate with the better real time traffic information and in the preparation for the future full scale hybrid C-ITS services.

C-ITS-G5 infrastructure will be deployed and tested will be relevant C-ITS Day 1 services on motorways within a limited area of the first phase pilot (A1 motorway section Postojna - Divača, length 30 km with at least 10 C-ITS G5 roadside stations). In the second phase roadside C-ITS-G5 infrastructure will be extended to the pilot length of 300 km on selected locations on complete motorway A1, A3 and H4 and at critical points of A2 with the Central C-ITS-G5 Server real-time platform located at Traffic Management Centre Dragomelj. Roadside C-ITS-G5 stations would also be installed at motorways cross-border areas to ensure coexistence of Cooperative ITS G5 with RTTT DSRC tooling system.

3G/4G/LTE Cellular Connected Vehicle with the Cloud Information Services will be deployed on complete motorway network by 2020. Upgraded will be national mobile traffic information application with the location and driving direction awareness and C-ITS services.

National assessment papers will be drafted and cross-fertilized with the C-Roads Platform assessment and evaluation plans and findings and a final C-Roads Pilot Slovenia evaluation will be delivered at the end.

Involved partners

- Ministry of Infrastructure
- DARS d.d. (Motorway Company of the Republic of Slovenia)

Location

The C-Roads Slovenia Pilot first phase (G5 and cellular) is planned along 100 km of TEN-T core network (Baltic-Adriatic and Mediterranean Corridor) in Slovenia and is located on the A1 highway (section Ljubljana – Koper), A3 (section Divača - Sežana) and H4 (section Razdrto – Vipava).

On the C-ITS Slovenia pilot site the "C-Roads Slovenia 2" roadside C-ITS-G5 infrastructure will be extended to pilot length of 300 km on selected locations on complete motorway A1, A3 and H4 and at critical points of A2 with the Central C-ITS-G5 Server real-time platform located at Traffic Management Centre Dragomelj.
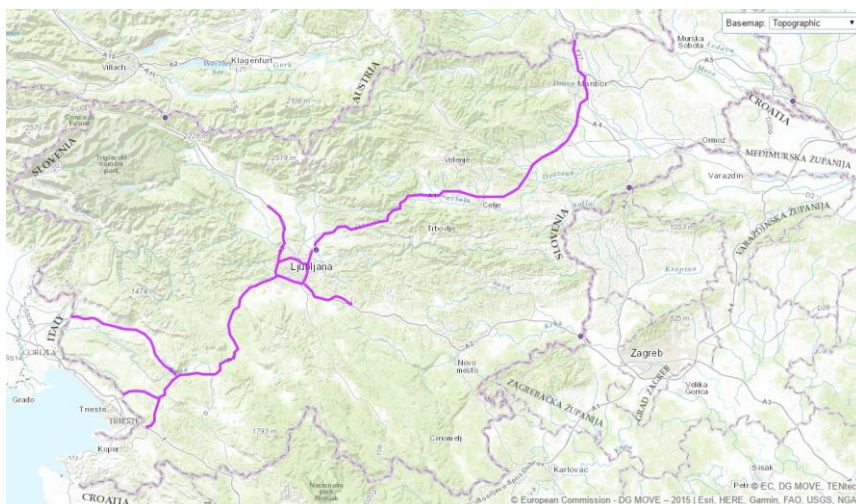
Figure 12: Location of the Slovenian pilot site

Overview of progress by End of 2018

A C-Roads Slovenia workgroup was formalized in 2017 which was active from the start in national activities and at C-Roads Platform. Workgroup members are beneficiary Ministry of Infrastructure, National Traffic Management Centre representatives and implementing body concessionaire Motorway Company of Republic of Slovenia DARS representatives. Technical workgroup representatives at implementing body DARS were assigned to actively participate in C-Roads Platform workgroups WG and taskforces TF. Ministry of Infrastructure nominates representative in Steering Committee and overlooks C-Roads Slovenia pilot.

For upgrade of ITS infrastructure C-Roads Slovenia pilot successfully started with the first tendering in 2016. Contracted upgrade of ITS road infrastructure with was deployed in 2016 and in the beginning of 2017. It has been integrated into existing traffic control and management system.

A tender for C-ITS Cellular Connected Car activity "Implementation of C-ITS over mobile networks 3G/4G/LTE" with included "Pilot C-ITS Mobile Application" was published and a contract was signed. Activity is ongoing and combines sub-activities

- C-ITS Cellular Connected Car and Cloud Information Services and
- Location-aware Application for End Users.

Testing of mobile application is expected in Q2 2019.

A tender for C-ITS-G5 Roadside Infrastructure Network activity was published and a contract was signed. Procurement is combined activity relevant for sub-activities:

- ITS Infrastructure Integration for Real Time Services,
- Availability of Traffic Information Service in Real Time and
- C-ITS-G5 Roadside Infrastructure.

Roadside infrastructure will consist of 10 C-ITS G5 roadside stations installed on A1 motorway section Postojna - Divača (length 30 km) and one C-ITS central station installed in RNC Kozina. Testing is expected in Q2 2019.

"C-Roads Slovenia 2 Pilot" is the extension of first C-Roads Slovenia Pilot and will start in mid 2019.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
154	172	555	1.999	5.416

9. The UK Pilot site

The A2/M2 Connected Vehicle Corridor (A2/M2 CVC) is to be established by the Department Of Transport in partnership with Highways England, Transport for London and Kent County Council. It will pilot the infrastructure, data management and service delivery necessary for connected vehicle services. This Corridor offers a variety of operating environments that make it attractive and unique as a pilot. Commencing in inner London near to Blackwall Tunnel with potential links to urban ITS applications; it provides the interface between the trunk road (A2), motorway network (M25 and M2) and Kent local roads (A229/A249).

The Corridor will be a pathfinder for future investment and the blueprint for the wider roll-out of connectivity across the UK road network. Importantly, when it is fully operational in 2019, it will provide an open test-bed where the UK motor manufacturing sector and after-market companies can develop new interactive customer services for C-ITS applications in addition to the core traffic and safety services which are market-ready. It will demonstrate how Connected Vehicle (CV) technology can help highway and roads authorities to manage their urban and inter-urban road network more effectively with the aim of achieving substantial benefits, shown in other trials (i.e. halving incident-related delays, reducing rear-end collisions by up to 12% and lowering fuel consumption /emissions by up to 25%).

The UK recognises the need for interoperability and the need to be able to operate across boundaries. The A2/M2 CVC project is the UK part of the InterCor ("Interconnected Corridors") programme with France, Belgium and the Netherlands – to develop a network of Corridors which link in to the C-ITS Corridor (Vienna to Rotterdam) and the French projects (SCOOP@F). This close collaboration between European states aims to ensure the interoperability of services. The functional and technical specifications that will be delivered through this project will help to ensure that future UK deployment of these services will be compatible and interoperable with European deployment of the four services (RMM, IVS, PVD and GLOSA).

Involved partners

- Department for Transport (DfT)
- Highways England (HE)
- Transport for London (TfL)
- Kent County Council (KCC)

Location

Figure 13: Location of the UK pilot site (Phases are indicative)

Overview of progress by End of 2018

The UK partners have continued to work with InterCor partners in France, Belgium and the Netherlands to revise and agree specifications for use in InterCor TESTFESTs. In parallel with pilot system preparation and road side equipment installation the UK provided input to the planning of the PKI TESTFEST in April 2018. The UK also worked with the Netherlands in preparing and holding a 'Pre-test' event in Helmond in June 2018 as part of our preparation for organising and hosting the Hybrid Communications TESTFEST in October 2018, where the first phase of pilot installation was tested.

During 2018 the UK has continued to develop the scope and location of the C-ITS pilot on the A2/M2 corridor, with responsibilities devolved to Transport for London, Highways England and Kent County Council including agreeing where on the corridor specific C-ITS services will be piloted. The first phase of installation was completed in September 2018 and supported the delivery of the Hybrid TESTFEST in October 2018.

The UK has developed a set of technical and operational specifications for the procurement, subsequent implementation and operation of the on-road pilot, which was scheduled to commence in November 2018, but due to contractual difficulties has been delayed until early 2019. The UK's approach to procurement, deployment and operation allowed for revisions to C-ITS specifications that may be subsequently issued by InterCor partners or C-Roads, to be incorporated as applicable at a later stage of the procurement and deployment process. This approach helps to mitigate risk to the validity of the pilot by helping us to plan a migratory path to current specifications, but has been more difficult to manage than originally anticipated.

The UK partners have made a significant contribution to evaluation activities during 2018 developing the Research Questions and detailed methodologies for particularly Impact, whilst contributing to User and Technical evaluation of InterCor. Our work in this area has helped us contribute effectively to Working Group 3 (Evaluation and Assessment) of the C-Roads platform.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
39.8	1,190.8	4,397.0	5,972.6	423.2

10.   The Belgium (Wallonia) Pilot site

The main objectives of the C-Roads Wallonia pilot are to operate and assess the deployment of several safety end-users services based on a cloud 'virtual infrastructure' with both long-range (cellular 3G/4G) and short-range (ETSI G5) communication mediums.

„Day 1 services" Slow or stationary vehicles, Traffic jam ahead warning, Road works warning, Weather conditions, In-vehicle speed limits and Other hazardous notifications will be deployed.

„Day 1,5 service" On-street parking management and information will be deployed to test truck parking availability and information throughout the 58 truck parking areas located in the pilot area.

A minimum of 1000 test drivers will be selected to evaluate the service quality based in particular on their feedback. The pilot will also include a limited number of road side units to test ITS-G5 communication and compare use cases testing.

Involved partners

- SOFICO (road operator)
- ITS.be (dissemination)
- Tractebel Engineering (evaluation)

Location

Figure 14: Location of the Belgium (Wallonia) pilot site

The pilot will be deployed along approximately 427 km of the following motorways:

www.c-roads.eu

- A3 (E40) : BK 44 → BK 135   [limit Flanders up to German border]
- A4 (E411) : BK 13 → BK 187   [limit Flanders up to Luxemburg border]
- A26 (E25) : BK 2 → BK 102   [between Liege and A4 interchange]
- A602 (E25/E40) : BK 0 → BK 13   [E25/E40 junction]

The pilot will however focus on a the A602 junction as it hosts important traffic volumes and features major security issues since it consists in an urban environment highway featuring a succession of tunnels and bridges through the city of Liège. Furthermore, many existing ITS equipment are already deployed which will help assess C-ITS message transmission in comparison to traditional fixed ITS messages.

Overview of progress by End of 2018

SOFICO's TRADEMEX public procurement has been notified. Its execution has started since beginning of September 2018. The following developments are under way:
- DATEX II node
- TEDD dynamic data management system based on vehicle-count data, which aims at generating road traffic conditions, and information data.
- A truck parking lot availability system which will allow day 1.5 use case foreseen in this pilot.

A procurement notice has been published for the implementation of a connected vehicle infrastructure in accordance with the Belgium/Wallonia pilot scope. Its aim is the installation of RSU units along the A602 highway and of a C-ITS platform within the traffic management centre. Four tenders have been received on December 14th 2018. The contract allows further RSU installation to extend the coverage of the infrastructure by as many as 40 additional RSU's. The target is to notify the winning contractor in April 2019 at the latest to allow development of the C-ITS services throughout 2nd, 3rd and 4th quadrimesters.

Finally, study is ongoing to prepare the third and final public procurement for C-ITS services communication via a smartphone application in order to test C-ITS services via cellular network for the whole pilot coverage area. The target is to publish the procurement notice in May 2019.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
-	18	208	2.424	1.678

11.   The Danish Pilot site

Denmark does not have its own national pilot, and consequently not a separate pilot budget. Denmark is part of NordicWay2 but is the only country in NordicWay2 without its own national pilot. It was cleared before signing the C-Roads platform agreement that it was okay for Denmark to become a C-Roads member due to the participation in NordicWay2 horizontal activities, despite Denmark not having a national pilot.

Denmark is contributing within the NordicWay2 horizontal activities, such as interoperability issues, data sharing, communication and tests – including testing on the Danish road network.

Involved partners

The Danish Road Directorate

Location

Danish state road network which means that all larger roads in Denmark are included.

Overview of progress by End of 2018

Danish Road Directorate contributes though the NordicWay2 pilot to the C-Roads Working Groups and Task Forces.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	50	130	240	240

12.   The Finnish Pilot site

The Finnish pilot site is part of the NordicWay2 pilots running in the Nordic countries Denmark, Finland, Norway and Sweden. The main objective of this Action is to deploy pilot studies in order to further develop interoperable Day-1 and Day 1,5 C-ITS services and support infrastructure readiness for connected and automated driving in Denmark, Finland, Norway and Sweden.

NordicWay2 pilots will:

1. Contribute to the harmonisation and interoperability of the C-ITS services in Europe in line with requirements agreed by the C-Roads Platform.

2. Support the deployment of new "Day-1" and "Day-1,5" C-ITS services in Nordic countries and extend its use in vital road freight transport routes subject to extreme weather conditions and in urban and interurban environments.

3. Support the infrastructure readiness for connected and automated driving in Nordic countries in snowy and icy arctic conditions.

4. Assess the socio-economic impacts of the piloted Day 1 and Day 1,5 C-ITS services as well as the effect on users mobility and traffic behaviours and on public acceptance.

The Finnish pilots are (1) the Artic Challenge for Automated driving in snowy and icy arctic conditions and (2) relevant C-ITS Day 1 services on core corridor.

Artic Challenge for Automated driving in snowy and icy arctic conditions
This pilot covers the design and implementation of a pilot intended to address automated driving in snowy and icy arctic conditions. The pilot will monitor automated driving with two different types of deployment phase automated vehicles.

Relevant Day 1 services on core corridor

This Activity contributes to specifically the specific objective of 2 and 4 by covering the design and implementation of a pilot to test relevant Day 1 services on the Scan-Med core corridor.

The following C-ITS services are piloted:

Day 1 C-ITS services:

- Hazardous location notifications:
    - Slow or stationary vehicle(s) & traffic ahead warning
    - Road works warning
    - Weather conditions
    - Emergency vehicle approaching
    - Other hazards

- Signage applications:
    - In-vehicle signage
    - In-vehicle speed limits
    - Signal violation / intersection safety

    ○   Green light optimal speed advisory (GLOSA)

<u>Day 1.5 C-ITS:</u>

- Traffic information and smart routing

The communication technology tested under the Finnish pilots will be cellular communication. Selected roadside infrastructure and vehicles are also equipped with ETSI ITS-G5 when needed to ensure interoperability.

Involved partners

The Artic Challenge for Automated driving in snowy and icy arctic conditions is led by the public authorities of Finnish Transport Agency (FTA) and Finnish Transport Safety Agency Trafi. Studies are carried out by the following three coalitions with 15 companies:
- Lapland University of Applied Sciences (leader) and Roadscanners ltd
- Sensible 4 Ltd (leader)
  - Metropolia University of Applied Science Ltd
  - Sharpeye Systems Ltd
  - MHR Consulting
  - F-Secure Ltd
  - Solidpotato Ltd
  - Nodeon Ltd
- VTT Technical Research Centre of Finland Ltd (leader)
  - Dynniq Finland Ltd
  - Indagon Ltd
  - Infotripla Ltd
  - Ukkoverkot Ltd.

The relevant C-ITS Day 1 and Day 1.5 service pilot was procured in 2018 by the public authorities of Finnish Transport Agency (FTA) and Finnish Transport Safety Agency Trafi. Pilot fleet will be set up from existing fleets, services and users in the market and includes in-vehicle displays and nomadic smart devices. The pilot implementation by three industry provider coalitions with 19 companies:
- EEE Innovations Ltd (leader)
  - Driveco Ltd
  - Looper IT Ltd
  - Lähitapiola Palvelut Ltd
  - Sensible4 Ltd
  - Swarco Finland Ltd
  - TraffICT Ltd
  - Tieto Finland Ltd
  - Defensec Ltd
- Infotripla Ltd (leader)
  - Arctic Machine Ltd
  - Ficonic Solutions Ltd
  - Finnish Meteorological Institute (FMI)
  - RoadCloud Ltd
  - SitoWise Ltd
- Posti Ltd and Vaisala Ltd (leaders)
  - Metsäteho Ltd

o Ahola Transport Ltd

Location

The Artic Challenge for automated driving in snowy and icy arctic conditions will take place in the Finnish-Norwegian E8 corridor, on a section of the comprehensive network section with frequent extreme weather conditions and low traffic volumes to minimise the safety risks involved with having automated vehicles driving on an open road together with manually operated vehicles.

The relevant C-ITS Day 1 and Day 1.5 services pilot will take place on the core corridor. The pilots will cover Finland's entire main road network (80 000 km).

Overview of progress by End of 2018

In 2017 the E8 Connected and Automated Driving Pilot tendering started early and three consortia with fifteen companies were selected through public tender, with signing of the contracts in September 2017. The pilot infrastructure main parts were built in 2017 and final tests and modifications done in 2018. Planning of the relevant C-ITS Day 1 services on core corridors was started in December 2017, with market discussion and the tendering of technical support.

In 2018 the pilot in activity "A7 – Finnish pilot 1 – The Arctic Challenge" was launched with a field test over a week in January 2018. Furthermore, the three piloting company consortia completed the second field test in October and November 2018. The pilot infrastructure work continued throughout 2018.

The Finnish activity "A8 – Finnish pilot 2 – Relevant Day 1 services on core corridors" was tendered in 2018. The tender was opened internationally 4 May 2018 for all stakeholders. The tender had two rounds: first eligibility of the companies was evaluated by 8 June 2018, then second, the companies selected in round 1 returned their first offers and negotiations held in September 2018. The final offers were received in October and the companies were evaluated based on their performance. At the end, three industry consortia including 19 companies were selected to implement the Finnish pilot. In addition studies of C-ITS and automation were advanced, e.g. Safety Related Traffic Information reindeer warnings.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	2.300	1.300	1.400	620

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Version 1.0

13. The Hungarian Pilot site

In Hungary, C-ITS deployment started within CROCODILE project Phase I in 2015, the improvement of road safety –especially in work zones – was the key issue.

A 136km-long stretch of the M1 motorway between Austria and Budapest was selected for C-ITS services pilot deployment. For maintenance vehicles, mobile RSUs were also installed, which can operate in stand-alone mode as well. The communication between RSUs and OBUs is thus far based solely on ITS G5. The system itself covers 'Day-1 services' comply with ECO-AT specifications – Release 2, 03/2015 – ('Traffic jam ahead warning', 'Hazardous location notification', 'Road works warning', 'Weather conditions', 'In-vehicle signage', 'In-vehicle speed limits'). The system architecture – the 3 components – follows the ECO-AT specifications, too.
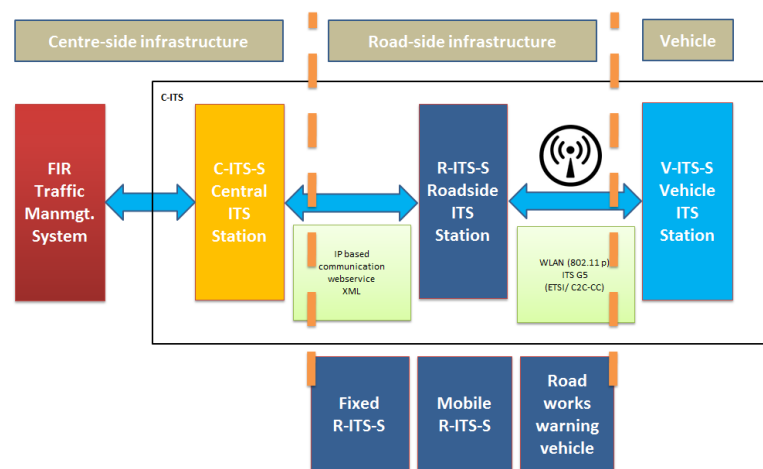
By the end of 2018, the existing pilot was extended to M0 ring-road around Budapest via CROCODILE project phase II.

In the framework of C-Roads Hungary pilot extension the Implementing Body intends to extend the C-ITS deployment both in terms of geographical coverage, and offered services. The focus shall be put on urban deployment, in particular *'Green Light Optimal Speed Advisory (GLOSA)'/'Signal Phase and Timing Information (SPTI)'* as well as *'Imminent Signal Violation Warning (ISVW)'*. Besides the existing I2V communication direction, aggregating CAM data via *'Probe Vehicle Data (PVD)'* service is also planned as a new data source for traffic management. The upgrade should also concern the communication technology – deployment of hybrid DSRC / cellular technology is envisaged in near future.

Involved partners

Beneficiary: Ministry for Innovation and Technology
Implementing body: Hungarian Public Road Non-profit PLC.

Co-operation – on different levels – with the following partners:
- Budapest University of Technology and Economics (BUTE)
- Automotive Proving Ground Zala LTD. (APZ)
- Budapest Public Road PLC.
- Road operator of the city of Győr
- Institute for Transport Sciences Non-profit LTD./Mobility Platform
- ITS Hungary Association (dissemination)

Location

With the extension, major part of motorway M7 (Mediterranean corridor) will be covered, and urban deployment will be carried out in the city of Győr by motorway M1 (Orient-East Med corridor). In order to improve coverage and ensure continuity of service, new transceivers and other devices will be implemented on motorway M1 Győr bypass section at the same time. This Győr bypass section is part of the existing 136-km-long M1 pilot section, motorway M1 between km 105-130. In the C-Roads Hungary project we are focusing on motorways M1, M7 and urban pilot in the city of Győr by motorway M1.
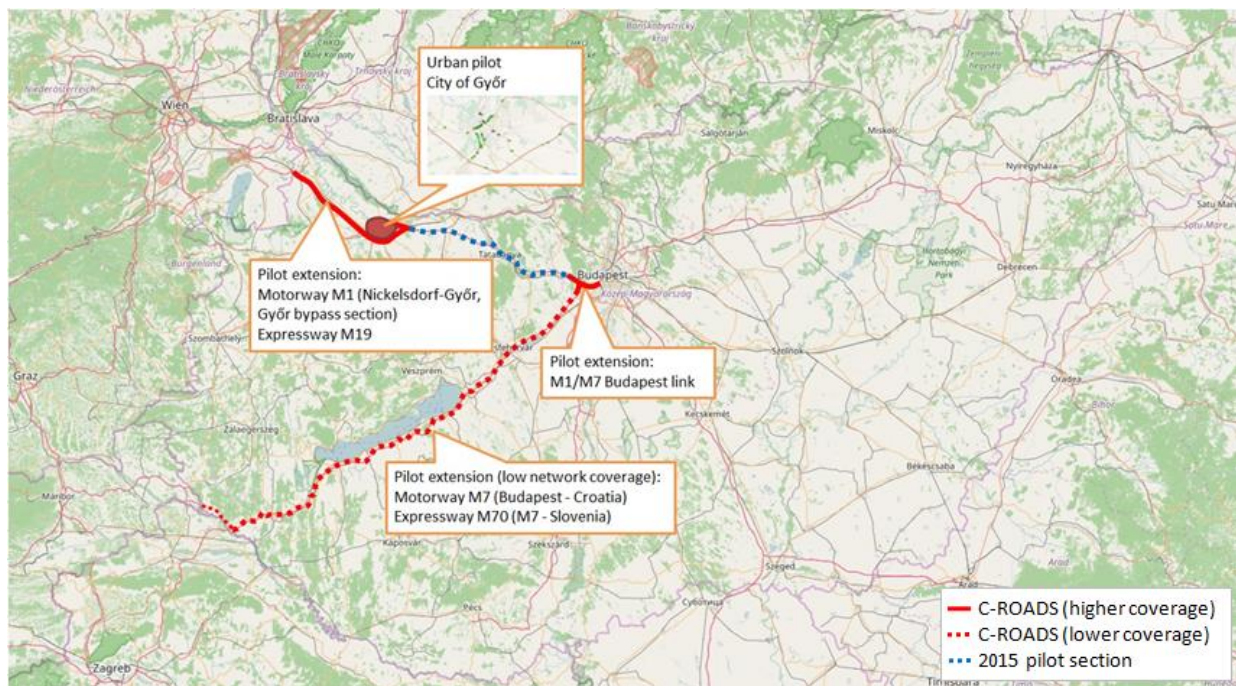

Figure 15: Location of the Hungarian pilot site

Overview of progress by End of 2018

Since Hungary was an associated member of C-Roads platform from 2016 (with the signature of the "Platform agreement for becoming an associated member"), Hungarian representatives were taking part in Steering Committee Meetings, and Technical Workshops. Moreover we have delegated experts to the working groups and Task Forces (in 2017, mainly to webex meetings), however Hungary became a full member of the Platform on 07/11/2017. From the beginning of 2018 on, Hungarian participation in the Platform Activities were arisen, at first, there was a huge need to keep up with the work done by the WGs and TFs so far, to understand the Platform work from inside the core group. Our experts became authors of common documents as well and participated at most of the personal meetings of each WG and TF. We are countinuously doing a strong dissemination work besides the C-Roads platform dissemination. We took the opportunities to held presentations, to spread brochures in order to ensure a great visibility, inform the relevant stakeholders and secure the success of the project.

Efforts were taken to implement domestic work programme, so the extension of the existing C-ITS pilot, too. Besides C-ROADS Hungary project, the parallel ongoing CROCODILE phase 2 and 3 projects also contain C-ITS investments, on different part of the motor-/expressway network – but the most relevant is of course C-ROADS Hungary. Via CROCODILE projects – based on the experience gained from C-Roads Platform activities, too -, mainly the geographical coverage was improved aiming work zone safety and this is the plan for the future, too. Nevertheless, as C-ROADS Hungary project has started with a bit more than one year delay comparing to CROCODILE 2 Hungary, the first "C-ROADS - Harmonised C-ITS Specifications for Europe – Release 1.3" compliant deployment in Hungary was already carried out via CROCODILE 2 project. It was a deployment on M0 ring-road around Budapest, at 10 locations and 3 more sites will be installed with RSUs beginning of 2019. These locations are already available for cross-testing for C-Roads partners.

The subsidy contract of C-ROADS Hungary was signed between Beneficiary and the Implementing Body on the 12th of April 2018. The procurement preparation for launching tenders have started, but after facing the experience with the pilot from 2015, which is already outdated from certain aspects, trying to minimise the problems might occur during later migration phase became a key issue. So, in order to avoid huge extra budget spent on the issues caused by tenders based on draft specifications, the process had to be frozen for a certain period while waiting for more and more updated/finalised specifications to rely on. The internal approval for planned procurements of the IB have been issued on the 12th of November 2018, after Rel 1.3 of harmonised specifications were accepted by 14 Member states and became available. The preparation for tendering is still ongoing, the first version of technical specifications have been prepared in line with the available C-Roads harmonised specifications.

All the tenders shall be ready for bidding in Q2 2019, after ministerial approval. Nevertheless the new and/or changing versions of ETSI and other relevant standards still indicates extra workload, mainly regarding the existing pilot and the missing hybrid specifications are also lengthening the process, the service contracts for the implementations are planned to be signed in 2019 Q3.

The issue of PKI still has to be solved, negotiations have started in 2018 in order to find a solution.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	0	26,1	590	1380,3

14. The Italian Pilot site

The main goal of the C-Roads ITALY project is to implement and test, in real traffic conditions, cooperative systems based on V2X technologies, for the following automated driving applications:
- trucks Platooning
- passenger cars Highway Chauffeur
- combined scenarios of trucks and passenger cars.

That implies the infrastructure upgrade and the integration of V2I C-ITS service and V2V information with vehicle control strategies.

C- Roads ITALY planned to pilot a set of "Day1" and "Day1,5" C-ITS services as recommended by the EC C-ITS Platform.

The expected impact to be demonstrated is mostly on mobility, considered in terms of:
1. Safety – to demonstrate the reduction of risk related to cooperative/automated technology in truck and passenger cars scenarios, and also in combined scenarios
2. Traffic fluidity – to show the potential for efficient use of the infrastructure with Platooning technology and Highway Chauffeur technology
3. Energy efficiency – to measure in real life conditions the potential for fuel consumption and related emission reduction.

The Italian implementing bodies (Road concessionaires, OEMs, telecom operator, research centre, etc…) will invest in their infrastructure and the industry will use that pilot test infrastructure to test components and services.

All Italian implementing bodies, according to their technical expertise, will be involved in the different WGs and Task Forces established by the C-Roads Platform; reporting about the status of national pilots, contributing to the harmonization of the different technical issues that will be discussed within the C-Roads Platform.

The results and lessons learned from C- Roads ITALY will be fully shared across Europe through the cooperation in the C-Roads Platform.

Involved partners

The Beneficiary (Member State) is the Ministero delle Infrastrutture e dei Trasporti the, the following entities are considered as implementing bodies:
- Iveco S.p.A.;
- North Italy Communications S.r.l.;
- Ministero dell'Interno – Dipartimento della pubblica Sicurezza – Servizio Polizia Stradale;
- Autostrada del Brennero S.p.A.;
- Codognotto Italia S.p.A.;
- Politecnico di Milano – Dipartimento di Design;
- Centro Ricerche FIAT S.C.p.A.;
- CAV Concessioni Autostradali Venete S.p.A.;
- Telecom Italia S.p.A.;
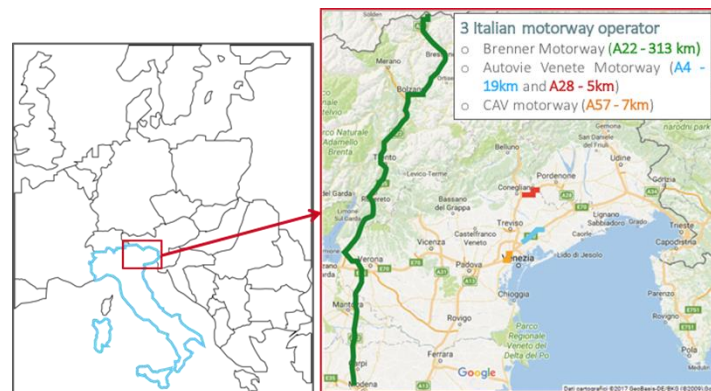- Azcom Technology S.r.l.;
- Autovie Venete S.p.A.

Location

Figure 16: Location of the Italian pilot site

Overview of progress by End of 2018

In 2018 C-Roads Italy has organized three Steering Committees and one technical management meetings:

- 2nd SC, 24-25/01/2018 2018 (Milano), 3rd SC, 30-31/05/2018 (Torino) and 4th SC, 04-05/10/2018 (Torino)
- Technical workshop on Use Cases. 6-7/03/2018 (Trento)

Also some internal technical meetings/workshops have been organized between national Implementing Bodies.

In C-Roads Italy, within the Activity 1 Project Management, there is also the Evaluation and Assessment sub-activity.

In 2018, the sub-activity led to the ex-ante evaluation documents, based on similar experiences and best practices that provided indications for the deployment of the project and for the assessment of the expected impacts. Specific reports were developed for the evaluation of Truck Platooning and Highway Chauffeur impacts based on literature overview, considering also the expected impacts of C-ITS Day-1 services and the combined effect of C-ITS and Platooning/Highway Chauffeur.

Activities of impacts assessment through modeling and simulation started, defining tools and data useful for this approach.

All the C-Roads Italy planned Milestones for 2018 have been achieved.

More in detail:

A2 "C-ROADS ITALY Pilot: Chauffeur"

At the end of 2018 "HC vehicle" and the "connected vehicle" were equipped and operational. A second "HC vehicle" was set-up, too and the planned started functional tests started. In addition, CRF and A22 organized the first call with C-Roads Austria for cross border UCs.

The implementing body CRF procured, tested and installed ETSI ITS G5 OBU's featuring Day 1 services/applications. Autostrada del Brennero infrastructure was operational in Q3 and message reception was tested by CRF from Trento to Brennero on a FIAT 500X ("connected vehicle").

Moreover, CRF, Autostrada del Brennero, IVECO tested in Ulm (Germany) with vehicles and mobile roadside units.

In Q4 2018 these Implementing Bodies, with Telecom Italia (Implementing Body too) setting up its AMQP broker, achieved hybrid connectivity, where the OBU receives C-ITS events also via 4G (payoald in ASN.1 encoding).

Data interface between V2X on board unit (OBU) and the Highway Chauffeur (HC) vehicle was specified.

A3 "C-ROADS ITALY Pilot: Platooning"

The following activities has been done:

- Complete analysis of the Platooning interaction with the C-ITS Day1 services implemented within the project (Use Cases)
- Identification of the Technology requirements and the functional architecture to fulfil the described Use Cases and Safety requirements
- Identification and selection of the suppliers/devices able to fulfil the mentioned requirements
- Definition of the first specifications for the hybrid communication, in accordance with the C-Roads Platform TF4
- V2X-G5 modules procurement and SW implementation plug-test in order to verify the correct sending/receiving of the ETSI ITS-G5 messages.
- 1st cooperation test among IVECO – CRF – Autostrada del Brennero in order to verify the implementation interoperability (Activity 2,3 and 4) in the IVECO proving ground.

Moreover, during the 2018, the Traffic Police has completed the report about the relationships among platooning, autonomous driving and Italian traffic regulations.

Activity 4 C-ROADS ITALY Pilot: Infrastructure update.

In 2018 Autostrada del Brennero installed 53 RSU in the places identified during on-site surveys the previous year, many more than foreseen by the Grant Agreement. Moreover, by Q3 the C-ITS server <-> TCC interface was developed and the implementation of the ITS-G5 Day-1 services has been achieved. During the preparation process of the infrastructure, the implemented ETSI G5 services was made available in order to verify, in a first testing phase, the correct functioning of the systems and the compliance of the coding, transport and decoding processes of the I2V and V2I messages. In Q4 the functional tests on the complete set of ETSI G5 Day-1 services foreseen by C-Roads Italy was carried out, achieving thus a coverage of 90% of what is foreseen during the project.
A strong cooperation has been established with implementing bodies Autostrada del Brennero, CAV and Autovie Venete to harmonies the management of C-ITS in the relevant TOC.
Moreover, in C-Roads Italy, about hybrid infrastructure communication, the implementing body Telecom Italia has developed and integrated a new functionality in OneM2M Platform (managed by the implementing body Telecom Italia) for managing AMQP protocol as defined in TF4 Architecture Document. The AMQP protocol was not a capability of OneM2M.
Afterwards Telecom Italia has released V2 OneM2M Platform (with AMQP capability) for the Hybrid approach. The Platform is currently in operation in the Telecom Italia Cloud and is connected with Autostrada del Brennero C-ITS-S and CRF OBU.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
-	2.238,99	6.123,41	12.966,11	20.864,03

15.   The Norwegian Pilot site

The Norwegian pilot site is part of the NordicWay2 pilots running in the Nordic countries Denmark, Finland, Norway and Sweden. The main objective of this Action is to deploy pilot studies in order to further develop interoperable Day-1 and Day 1,5 C-ITS services and support infrastructure readiness for connected and automated driving in Denmark, Finland, Norway and Sweden.

NordicWay2 pilots will:

1. Contribute to the harmonisation and interoperability of the C-ITS services in Europe in line with requirements agreed by the C-Roads Platform.

2. Support the deployment of new "Day-1" and "Day-1,5" C-ITS services in Nordic countries and extend its use in vital road freight transport routes subject to extreme weather conditions and in urban and interurban environments.

3. Support the infrastructure readiness for connected and automated driving in Nordic countries in snowy and icy arctic conditions.

4. Assess the socio-economic impacts of the piloted Day 1 and Day 1,5 C-ITS services as well as the effect on users mobility and traffic behaviours and on public acceptance.

The two Norwegian pilots include (1) use cases of Day 1 and Day 1.5 C-ITS services on the peripheral networks and (2) mapping of infrastructure readiness for connected and automated driving on major freight routes of the comprehensive network in Norway

Use cases of Day 1 and Day 1.5 C-ITS services on the peripheral networks

The pilot will design, and implement, test and evaluate use cases of Day-1 and Day-1.5 C-ITS services on the peripheral networks, to allow for smooth transitions between the networks.

Testing on the comprehensive and peripheral networks ensures a broader test of functionality than on the core network. If tests are successful on the peripheral or comprehensive network, the Day-1 and Day-1,5 C-ITS services tested will be applicable under extreme weather conditions on the core network.

In particular, the pilot will explore the feasibility of the following Day-1 and Day-1,5 services on these rural routes with poor cellular connectivity and without full access to power mains:

Day 1 services:

- Hazardous location notifications:
    - Slow or stationary vehicle(s) & Traffic ahead warning
    - Road works warning
    - Weather and road conditions
    - Emergency brake light
    - Other hazardous notifications

- Signage applications:
    o In-vehicle signage
    o In-vehicle speed limits
    o Signal violation/ intersection safety
    o Green light optimal speed advisory
    o Probe vehicle data

Day 1.5 services:
- Information on fuelling & charging stations for alternative fuel vehicles
- On street parking information and management
- Traffic information & Smart routing
- Cooperative collision risk warning

The interoperability of the following C-ITS services will be tested throughout the whole NordicWay2 network:

- Slow or stationary vehicle(s) & Traffic ahead warning
- Weather conditions
- Traffic information & Smart routing

The service "Weather conditions" will include slippery road detection since this is an important functionality to ensure traffic safety and traffic ability on rural roads in wintertime. Moreover, the "Green light optimal speed advisory" test will be oriented to test the use of the virtual "traffic lights".

The communication technology tested under this pilot will be cellular communication. Selected roadside infrastructure and vehicles may also be equipped with ETSI ITS-G5 when needed to ensure interoperability.

Mapping infrastructure readiness for connected and automated driving on major freight routes of the comprehensive network in Norway

The pilot will map and assess the infrastructure readiness for connected and automated driving on major freight routes of the comprehensive network in Norway.

The pilot will aim at identifying what parts of the network are hard to read for the vehicle sensors and exploring the potential for communicating information from the road authorities' backend instead of rebuilding the infrastructure using C-ITS. The pilot will cover a larger area, but this area will not require instrumentation as the pilot is to study infrastructure readiness. The area already is equipped with connected signalized intersections in Trondheim and in Oslo. The route will start at the E8/Finish border and continue south on the E6 to Trondheim and from there down to Oslo and onwards to the Swedish border.

In case that the results of the pilot as described above are inconclusive, the pilot area will be extended to the E136 on the peripheral network from Åndalsnes to Dombås in the Norwegian pilot. This road is a major freight route from Western Norway with a steep incline through a valley with tunnels, high mountains on both sides and with the challenges this entails concerning connected and automated driving. The results from E136 will be applicable under extreme weather conditions on the core network.

Involved partners

Norwegian Public Roads Administration and public sector and private sector partners through open tendering processes

Location

The C-ITS pilot will be on the corridor from Tromsø to the Finnish border. The main pilot stretch will be from Skibotn to Kilpisjärvi, but other road sections on E8 and connecting roads can be included in pilot activities if it is appropriate to cover specific issues.

The mapping of the infrastructure for connected and automated driving readiness will start at the E8/Finish border and continue south on the E6 to Trondheim and from there down to Oslo and onwards to the Swedish border.

Overview of progress by End of 2018

In 2017 the infrastructure preparations took place along the E8 corridor from Tromsø to the Finnish border, accompanied by the first round of procurement of C-ITS Pilots.

In 2018 the Norwegian pilot plan for C-ITS services was completed. The basic infrastructure along the E8 corridor from Tromsø to the Finnish border was also completed. Some initial tests on C-ITS solutions were carried out.

The implementation of C-ITS pilots is done through an innovation procurement process where 5 companies have been selected. An innovation procurement involves a selecting process in four stages where a number of companies are invited to present their idea, develop a concept, then prototype and finally demonstrate the solution. During the four-stage process the companies with the best solutions are invited to continue to the next stage. Hence there is also a selection process throughout the innovative procurement. Innovative procurement is a way the public sector as a "demanding customer" can stimulate, through their purchases, innovation and the development of new forward-looking solutions.

Two of the C-ITS services will be demonstrated on the E6 between Oslo and Svinesund at the Swedish border, and a tender has been carried out to search for service providers.

In another activity related to the the readiness for connected and automated driving, the cellular 4G coverage has been measured and estimated on major freight routes of the comprehensive and core networks. On these routes, the percentage of the road stretches without 4G cell coverage varies between 0.1% and 40% on some stretches. Roads without 4G coverage will affect the performance of the C-ITS priority services.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	1.700	1.500	1.650	750

16.   The Portuguese Pilot site

C-Roads Portugal consists in the deployment of 5 C-ITS testbed Macro Pilot cases in the Atlantic Corridor in Portugal, covering relevant sections of the core network and comprehensive network and of its two urban nodes.
Combined with the testbed pilot cases, the project will also develop a study aiming for the National large-scale deployment of C-ITS services, notably Day-1 services and, selected, Day-1,5.

Pilot 1 – Single Access Point – SPA and SPApp usage app for SPA Services
This activity consists on the design of the National Single Point of Access (SPA) prototype designed in compliance with the Commission Delegated Regulation (EU) 2015/962 and the Commission Delegated Regulation 886/2013 and covering information of around 3390 km (20%) of the network. In addition, a mobile application (SPApp) that will provide added value services on the basis of the information provided by the SPA will be also tested together with the SPA prototype. This pilot will pave the way for the future implementation of the SPA in Portugal.

Currently, in Portugal, there are several traffic data producers, namely the different road operators such as BRISA, ASCENDI or NORSCUT, that send information to distinct entities (already) in DATEXII format. This means that, although already using an open UE standard for traffic data exchange, there is no official Portuguese National Access Point.

The pilot will consist of the following two sub-activities:
Sub-activity 1.1: The first sub-activity will identify the technical and financial requirements, both in terms of hardware and software, to establish the SPA on the basis of the existing traffic data communication network. In particular, the following aspects will be analysed and defined:
- specific requirements to set up the SPA in compliance with the Commission Delegated Regulation (EU) 2015/962 and the Commission Delegated Regulation (EU) No 886 / 2013;
- system modelling including the data interfaces according to the DATEXII model; normalization of the data frames sent by each road operator;
- the "discovery/search and browse" functionality

Moreover, a prototype to validate the approach and analyse the different required functionalities will be developed and piloted. This prototype will be tested (i.e. pilot operation) before the major deployments of other pilots carried out under the other activities are taken place, enabling its usage as the data sharing point for the different collaborative services in test.

Sub-activity 1.2: This sub-activity covers the design and development of a SPA mobile application (SPAapp) based on an existing technological platform that will enable interactive added-value services between the driver and the highway operator. In particular the app will cover the following Day-1 C-ITS services:
- Day-1 C-ITS services:
- Slow or stationary vehicles;
- Traffic Jam ahead warning;
- Other hazardous location notification;
- Road works warning;
- Weather conditions.

This app looks to demonstrate the potential of the SPA base services. In particular this Activity will design and develop an application layer for static road data, dynamic road status data and

traffic data provided by the data sharing backbone system delivered under sub-activity 1.1 (i.e. the basis for the future SPA in Portugal). The system will compile transportation data from the nodes provided by SPA to be used by a consumer-facing app. The SPAapp will be tested together with the SPA prototype as a part of the pilots delivered under other activities.

This Activity will cover the procurement tasks, i.e. the preparation of procurement documents and contracts, which are necessary to implement the above sub-activities.

Pilot 2 – Portuguese network for C-ITS
This activity consists on the deployment of a pilot to test Day 1 and Day 1.5 services over 460 km of the core and comprehensive network, including cross-border sections in Valença and Caia, and roads giving access to urban nodes of Lisbon and Porto.
This activity will test these services in different kind of roads (metropolitan areas, interurban roads, streets and highways) using hybrid communication system (ITS G5 and Cellular).

The activity is desegregated in the following sub-activities
Sub-activity 2.1: Demonstration of C-ITS services in the core (A1, A2, A3, A6 and A12) and comprehensive (A2, A22, A27 and A28) network, including cross-border sections in Valença (A3 and A28) and Caia (A6), and roads giving access to urban nodes of Lisbon (IC 17 and IC 19) and Porto (A4 and A20 — VCI).

This sub-activity will expand the network of cooperative systems on the basis of the results of a CEF funded Action 2014-EU-TA-0669-S- SCOOP@F Part 2 with the deployment of around 88 RSU, 29 OBU and 29 vehicles testing the following Day-1 and Day -1.5 C-ITS services:
- Day-1 C-ITS services:
- Emergency electronic brake light;
- Emergency vehicle approaching;
- Slow or stationary vehicles;
- Traffic Jam Ahead warning;
- Other hazardous location notification;
- Roads works warning;
- Weather conditions;
- In-vehicle signage;
- In-vehicle speed limits;
- Probe vehicle data;
- Shockwave damping.

- Day-1.5 C-ITS services:
- Off street parking information;
- Park and Ride information;
- Information on alternative fuel vehicles and charging stations;
- Traffic information and smart routing;
- Zone access control for urban areas;
- Wrong way driving.

Sub-activity 2.2: Development and testing of an in-vehicle app that will provide C-ITS services to the users on the highway A25 and urban node of Lisbon (entrance through the N6 road)
This sub-activity will develop and test an In-Vehicle App, using a hybrid communication system (ITS G5 + cellular), that will be able to provide the following Day-1 and Day -1.5 C-ITS services on the highway A25 and on the access to the urban node of Lisbon through the N6 road :

- Day-1 C-ITS services:
  - Slow or stationary vehicles;
  - Traffic Jam Ahead warning;
  - Other hazardous location notification;
  - Roads works warning;
  - Weather conditions.

- Day-1.5 C-ITS services:
  - Off street parking information;
  - Traffic information;
  - Smart routing.

The sub-activity will cover the following task:
- Development of the in-vehicle App;
- Installation of 24 RSU on two roads: A25 and N6 (access to urban node of Lisbon);
- Installation of 20 OBU in 20 vehicles;
- Connection of the in-vehicle App with the server(s) that will receive and process the information received from the installed RSUs and OBUs,
- Piloting of the In-vehicle App: the provision of all C-ITS services by the in-vehicle App will be tested and monitored during a period of at least 12 months.

Sub-activity 2.3: Development of C-ITS services in tunnels: Túnel da Gardunha (A23)
This sub-activity will pilot the provision of Day-1 C-ITS services inside and in the surroundings of the "Gardunha tunnel" located in the A23 road using a hybrid communication system (ITS G5 + cellular).

- Day-1 C-ITS services:
  - Emergency vehicle approaching;
  - Slow or stationary vehicles;
  - Traffic Jam Ahead warning;
  - Other hazardous location notification;
  - Roads works warning;
  - Weather conditions;
  - In-vehicle signage;
  - In-vehicle speed limits.

The sub-activity will cover the following task:
- Installation of 6 RSUs in 20 km of the A23, inside and outside the "Gardunha tunnel;
- Equipment of 10 vehicles with 10 OBUs,
- Testing and monitoring of the provision of the Day-1 C-ITS services inside and in the surroundings of the tunnel during a period of 12 months.

This Activity will cover the necessary adaptation of the vehicles to perform the pilots and will cover the procurement tasks, i.e. the preparation of procurement documents and contracts, which are necessary to implement the above sub-activities.

Pilot 3 – Network preparation for Connected and Autonomous Vehicles
This activity consists on the deployment of a pilot that will prepare TEN-T network for Connected and Autonomous Vehicles with levels of automation 2 and 3, also using hybrid communication system (ITS G5 and Cellular).

This activity covers three sub-activities that will carry out the following pilots in real environment.

Sub-activity 3.1: Pilot of Connected and autonomous vehicles in open roads

Under this sub-activity, around 6 RSU will be installed over around 24.7 km of the A27 highway (Viana do Castelo - Ponte de Lima), 88.6 km of A28 (Porto-Caminha) and 40 km of the A3 (Porto-Braga).

Moreover, one vehicle will be equipped with two different OBUs in order to test with two different levels of automation (level 2 and 3) the provision of the following Day-1 and Day-1.5 services:

- Day-1 C-ITS services:
  - Emergency electronic brake light;
  - Slow or stationary vehicles;
  - Traffic Jam Ahead warning;
  - Other hazardous location notification;
  - Roads works warning;
  - Weather conditions;
  - in-vehicle signage;
  - in-vehicle speed limits;
  - Signal violation/intersection safety.

- Day-1.5 C-ITS services:
  - Off street parking information;
  - Park & ride information;
  - Connected and cooperative navigation.

Sub-activity 3.2: Pilot on the A2, the "Holiday motorway"

This pilot will be implemented over 240km of the A2 network ("Intelligent Holliday Motorway" from Almada to Albufeira) and will involve some of the RSUs and OBUs installed under sub-activity 2.1 as well as around 50 additional RSUs that will be installed under this sub-activity. The pilot will test the provision of the following Day-1 and Day-1.5 services with around 30 vehicles (cars and trucks):

- Day-1 C-ITS services:
  - Emergency electronic brake light;
  - Slow or stationary vehicles;
  - Traffic Jam Ahead warning;
  - Other hazardous location notification;
  - Roads works warning;
  - Weather conditions;
  - In-vehicle signage;
  - In-vehicle speed limits;
  - Probe vehicle data.

- Day-1.5 C-ITS services:
  - Park & ride information;
  - Information on alternative fuels & charging stations;
  - Traffic information;
  - Smart routing;
  - Zone access control for urban areas;
  - Wrong way driving;
  - Connected and cooperative navigation.

Sub-activity 3.3: Pilot on Connected vehicles for advanced services.
This pilot will be implemented over 204 km of highways of the Core network and accesses to urban nodes (66 km of A1, 54 km of A2, 25 km of A5, 35 km of A9 and 24 km of A12) and will involve some of the RSUs and OBUs installed under sub-activity 2.1 as well as around 30 additional RSUs and 50 OBUs that will be deployed under this sub-activity. The pilot will be carried out with around 50 vehicles that will test the following Day 1 and Day 1.5 services:

- Day-1 C-ITS services:
- Emergency electronic brake light;
- Slow or stationary vehicles;
- Traffic Jam Ahead warning;
- Other hazardous location notification;
- Roads works warning;
- Weather conditions;
- In-vehicle signage;
- In-vehicle speed limits;
- Probe vehicle data.

- Day-1.5 C-ITS services:
- Park & ride information;
- Information on alternative fuels & charging stations;
- Traffic information;
- Park & ride information;
- Information on alternative fuels & charging stations;
- Traffic information;
- Smart routing;
- Zone access control for urban areas;
- Wrong way driving
- Connected and cooperative navigation.

Under this sub-activity in-vehicle/driver data will be analysed in order to feed data models to adequate traffic and guidance information. Additionally, this pilot will deploy a dynamic route pricing system that will calculate the price according to the distance travelled, type of roads and levels of congestion, usage-based insurance models and road usage charging models.

Pilot 4 – C-ITS Pilot in the Lisbon Urban Node
This activity consists in the deployment of a C-ITS Pilot in the Lisbon urban node.

The activity covers three sub-activities:
Sub-activity 4.1: Traffic service level monitoring and travel time prediction in Lisbon node to be tested along 10,5 km of A36 (2ª circular) using cellular communication.

This sub-activity will deliver and pilot an application that will provide the following Day-1 and Day 1.5 C-ITS services over the 10,5 km of A36 (2ª circular) using cellular communication:

- Day-1 C-ITS services:
- Slow or stationary vehicles;
- Traffic Jam Ahead warning;

- Day-1.5 C-ITS services:
- Traffic information;

- Smart routing;

This application will retrieve data on total vehicle volumes (with classes identification) to generate at least two O/D (origin/destination) pairs that will feed the municipal Traffic Management Centre. The RSUs deployed under activities 2.1. and 2.2. over the IP network IC 19/ CRIL/A36) will also be connected to this pilot case.

Sub-activity 4.2: Pilot of a Parking availability system in Lisbon node (Lisbon central axis - Entrecampos - Marques do Pombal, along 2,7 km)

This sub-activity will deliver and pilot with around 25 vehicles an integrated C-ITS application that will be able to provide the following Day-1,5 C-ITS services using cellular communication:

- Day-1.5 C-ITS services:
  - On-street parking;
  - Off-street parking;
  - Park & ride information;
  - Information on alternative fuels & charging stations;
  - Smart routing;

This C-ITS application will built on the existing EMEL Smart Parking Solution which is an integrated infrastructure-based sensor system that gives precise information on where available parking spaces in Lisbon can be found and how long each space has been occupied.

The EMEL Smart Parking Solution will be integrated with other technologies and improved in terms of the robustness of sensor devices, the stability and timeliness of sensor networks, the quality and agility of urban service, and user-centred considerations in order to be able to provide the services specified above.

Sub-activity 4.3: -Pilot of an In-Vehicle App that provides parking and traffic information in the Urban Node of Lisbon (Lisbon Node, 9.8 km of A36 (2ª circular) and N6)
This pilot will test an In-vehicle App that will provide information about parking availability inside the city (Day-1.5 service) and about traffic conditions and hazardous situations (Day-1 services) over 9.8 km of one of the most congested access road to Lisbon and main connection to the core airport (A36 – 2ª Circular) and over the N6 (one of the 5 main commuting entrances).
The test will involve 5 vehicles and will use hybrid technologies (ETSI G5 and Cellular).

Vehicles (cars, buses, trucks) shall be equipped with smartphones/tablets where the app prototype will be available along with the V2X-enabled In-Vehicle System (IVS) that allows the collection of data on the vehicle environment (like road conditions, driving conditions, traffic conditions and general environmental conditions) while at the same time acting as a receiver of information coming from other vehicles and/or the central C-ITS management system.

The app prototype will make use of state-of-the-art recommendations related to ensure safe driving while relaying the required information to the driver. Moreover, specifications already adopted by the C-Roads platform and technology neutrality and efficient use of radio spectrum will be key principles in order to ensure complementarity and co-existence with existing communication technologies.

Sub-activity 4.4: Signal corridors and bus corridors prioritization in Lisbon node

Endow the central corridor of Lisbon ("Campo Grande - Marques de Pombal" axis) with the suitable infrastructure capable of improving the efficiency of the public transport lanes by prioritising the emergency vehicles.

This solution will allow to implement a prioritization system (Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)) based on cellular communication technology through the adaptation of the existing OBUs and communication server and via the upgrade of the central traffic management and the development of middleware.

Sub-activity 4.5: Mobility hub in the Lisbon node

This pilot will cover some of the inter-urban highways that give access to Lisbon (A2, A5 and A9). Through this pilot test, the potential benefits of the integration of private car usage with other modes of transportation in the last mile of inter-urban motorway corridors will be studied and evaluated through the analysis of solutions such as carsharing, carpooling, park & ride or any other services which contributes to the implementation of the "mobility as service" (MAAS) concept.

Moreover, the pilot will also test the provision of the following Day-1 and Day 1.5 services using hybrid communication technologies (ETSI G5 and Cellular communications):

- Day-1 C-ITS services:
  - Emergency electronic brake light;
  - Emergency vehicle approaching;
  - Slow or stationary vehicles;
  - Traffic Jam Ahead warning;
  - Other hazardous location notification;
  - Roads works warning;
  - Weather conditions;
  - In-vehicle signage;
  - In-vehicle speed limits;
  - Probe vehicle data;
  - Shockwave damping.

- Day-1.5 C-ITS services:
  - Park & Ride information;
  - Information on alternative fuel vehicles and charging stations;
  - Traffic information;
  - Smart routing;
  - Zone access control for urban areas;
  - Wrong way driving.

Pilot 5 – C-ITS Pilot in the Porto Urban Node
This activity consists in the deployment of a C-ITS Pilot in the Porto urban node.

Under this Pilot, the following two sub-activities will be tested:
Sub-activity 5.1: Pilot to test a Cooperative Intelligent Transport System (C-ITS) for short-medium term traffic predictions in Porto node

This sub-activity will test a Cooperative Intelligent Transport System that will provide traffic predictions in real time and in future-two-hour travel time using Cellular, Wifi and DATEX communication technologies.

This system will transfer real-time traffic information such as traffic flow, traffic speed, traffic concentration, accident occurrence, congestion, roadworks and public transport information to the traffic management centre (TMC) enabling the TMC to react and put in place contingency plans to tackle network bottlenecks and other traffic disruptions.

The pilot will monitor the traffic service level in real time and will predict the service level in 2 hours, in a total extension of about 24 km inside the Porto city.

The equipment deployed in sub-activity 2.1 will be connected to this pilot allowing to extend the area covered by the pilot (i.e. covering critical penetration roads in Porto such as commuting entrance/exits of the urban node).

The Day-1 and Day 1.5 C-ITS services that will be tested under this pilot are the following:
- Day-1 C-ITS services:
- Traffic Jam Ahead warning;
- Roads works warning;
- Weather conditions;
- In-vehicle signage;
- Shockwave damping;
- Traffic signal priority request by designated vehicles.

- Day-1.5 C-ITS services:
- On-street parking management;
- On-street parking information;
- Traffic information;
- Smart routing.

Sub-activity 5.2: V2I and I2V integration of an intelligent bus with the infrastructure in Porto node

This pilot will test the integration of an "intelligent bus" with the infrastructure in the city of Porto in a corridor of around 1,4 km for information and services sharing, using DATEXII communications protocol and cellular communication technologies. The pilot will require the installation of at least a RSU and the equipment of the intelligent bus with at least an OBU. This will allow the exchange of information between the infrastructure owner and the intelligent bus.

The following Day-1 and Day 1,5 C-ITS services will be tested:

- Day-1 C-ITS services:
- Traffic Jam Ahead warning;
- Roads works warning;
- Weather conditions;
- In-vehicle signage;
- n-vehicle speed limits;
- Probe vehicle data;
- Shockwave damping;
- Traffic signal priority request by designated vehicles.

- Day-1.5 C-ITS services:
- Traffic information;
- Smart routing;
- Connected and cooperative navigation.

This pilot's activities have experienced a relevant development.

Involved partners

The C-ROADS PORTUGAL involves 31 Partners from the public and private sector:

- Instituto da Mobilidade e dos Transportes, I.P.;
- Infraestruturas de Portugal, I.P.
- IP Telecom, S.A.;
- Câmara Municipal de Lisboa;
- Câmara Municipal do Porto;
- STCP - Sociedade de Transportes Coletivos do Porto, S.A.;
- EMEL - Empresa Publica Municipal de Estacionamento de Lisboa, E.E.M.;
- FEUP - Faculdade de Engenharia da Universidade do Porto;
- Brisa Concessão Rodoviária, S.A.;
- Ascendi Beiras Litoral e Alta, Auto Estradas das Beiras Litoral e Alta, S.A.;
- Autoestradas Norte Litoral – Soc. Concessionaria - AENL, S.A.;
- Autoestrada do Algarve - Via do Infante – Soc. Concessionaria - AAVI, S.A.;
- CaetanoBUS - Fabricação Carroçarias, S.A.;
- Brisa Inovação e Tecnologia, S.A.;
- GMVIS Skysoft, S.A.;
- ARMIS, Sistemas de Informação, Lda.;
- Siemens, S.A.;
- Vialivre, S.A.;
- DMS Displays & Mobility Solutions Lda.;
- Scutvias - Autoestradas da Beira Interior, S.A.;
- Lusoponte - Concessionaria para a Travessia do Tejo, S.A.;
- Brisal - Autoestradas do Litoral, S.A.;
- AEDL - Autoestradas do Douro Litoral, S.A.;
- AEA - Autoestradas do Atlântico- Concessões Rodoviárias de Portugal, S.A.;
- Ascendi Grande Lisboa - Autoestradas da Grande Lisboa, S.A.;
- Ascendi do Grande Porto - Autoestradas do Grande Porto, S.A.;
- Ascendi Norte - Autoestradas do Norte, S.A.;
- Ascendi Costa de Prata - Autoestradas da Costa de Prata. S.A.;
- Norscut Concessionaria de Autoestradas, S.A.;
- TIS.PT, consultores em Transportes, Inovação e Sistemas. S.A.;
- Via Verde Serviços, S.A.;

Location

Region(s) (using the NUTS2 nomenclature): Alentejo (PT18), Algarve (PT15), Centro (PT) (PT16), Lisboa (PT17), Norte (PT1 1)
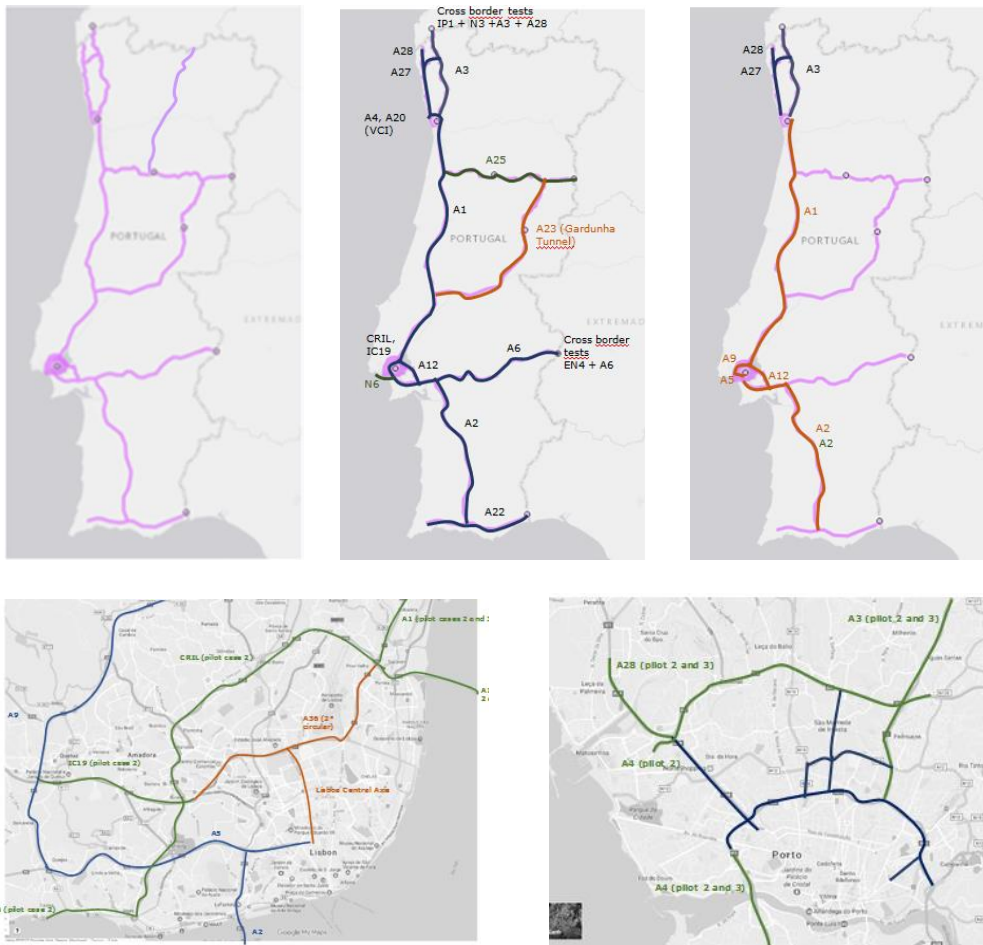
Pilots 1 to 5

Figure 17: Location of the Portuguese pilot site

Overview of progress by End of 2018

The majority of Activities within the Action have been progressing with delay if compared with the expected track during this reporting period. Although some activities (namely Pilot 3 – Network preparation for Connected and Autonomous Vehicles) did perform as expected, there is an overall delay within the Action.

This delay is in part explained by the sequential characteristic of the project, that imposes that if one of the early activities experiences a significant delay, it will have a relevant impact along the entire project.

This in fact happened, with a delay on Activity 3 (Specifications) representing a delay on Activities 4 (Pilot Requirements) and 5 (Validation and Testing), which in turn has a significant (and potentially amplified delay) in the Pilot Activities.

Another potential cause for this delay arises from the need to establish public and private tenders for equipment and services within the Pilot Activities. The delayed input from Activities 3, 4 and 5 implied a very delayed process for the establishment of specifications in tenders.

Pilot 1 – Single Access Point – SPA and SPApp usage app for SPA Services

This activity has included extensive discussions on the SPA governance model and property due to the presence of public and private entities with different points of view. This delayed the overall progress of this activity.

These discussions are nevertheless, considered necessary and useful due to the need to establishing a solid foundation for this system and will furthermore provide useful data for Business Models planned for activity 11 (Integrated Impact Assessment).

Pilot 2 – Portuguese network for C-ITS

This pilot activity was specifically affected to the delays registered in activities 3, 4 and 5.
Below a schematic representation of the current development status for this pilot activity.

A-to-Be (Brisa)

Use Case Day 1	Specifications date	1st Validation Location	1st Validation date
PVD-ADC	10/2018	A9	Q2/2019
HLN-SV	10/2018	A9	Q2/2019
HLN-TJA	10/2018	A9	Q2/2019
HLN-APR	10/2018	A9	Q2/2019
HLN-WCW	10/2018	A9	Q2/2019
HLN-EVA	11/2018	A5	Q4/2019
HLN-EBL	-	-	-
RWW-LC	11/2018	A5	Q4/2019
IVS-DSLI	11/2018	A5	Q4/2019
IVS-EVFT	11/2018	A5	Q4/2019
IVS-OSI	Q2/2019	-	-
SWD	Q2/2019	-	Q4/2019

Use Case Day 1,5	Specifications date	1st Validation Location	1st Validation date
HLN-AWW	Q2/2019	-	Q4/2019

Some contacts have already been made with our Spanish partners to describe the cross-border C-ROADS tests in A6.

Infraestruturas de Portugal

Use Case Day 1	Specifications date	1st Validation Location	1st Validation date
RWW – LC	09/2018	A4	T2/2020
RWW – RC	09/2018	IC17	T2/2020
RWW – ROVI	06/2019	IC19	T2/2020
RWW – LT	06/2019	N6	T2/2020
HLN – AZ	09/2018	A4, IC17, N6	T2/2020
HLN – TJA	09/2018	A4, IC17, N6	T2/2020
HLN – SV	09/2018	IC19, IP1	T2/2020
HLN – WCW	09/2018	A4, IC19, IP1	T2/2020
HLN – APR	09/2018	IC19, IP1	T2/2020
HLN – OR	09/2018	A4, IC19, IP1	T2/2020
HLN – SL	06/2019	N6	T2/2020
HLN – AWD	06/2019	A4, IC17, IC19	T2/2020
IVS – DSLI	09/2018	A4, IC17	T2/2020
IVS – EVFT	09/2018	IP1, IC17, IC19, N6	T2/2020
PVD – DE	06/2019	IC17, IC19, N6	T2/2020

Some contacts have already been made with our Spanish partners to describe the cross-border C-ROADS tests in IP1.

AENL

Use Cases already tested			
Use Case	Test date	Location of test	Comments
Highway Access	30/10/2018 28/02/2019	A27	Trials made. Improving according results
Behavior of the autonomous vehicle following another one	12/03/2018 - 14/03/2018	A27	Trials made. Improving according results
Lane Change behaviour	12/03/2018 - 14/03/2018	A27	Trials made. Improving according results
Behaviour in case of previous vehicle at slower speed/congestion	12/03/2018 - 14/03/2018	A27	Trials made. Improving according results
Behavior in low visibility conditions	12/03/2018 - 14/03/2018	A27	
Information and recommendations during	12/03/2018 - 14/03/2018	A27	Working on conclusion
Lines that allow a greater view of the sensors	2018	A27 A28	Working on conclusion
Safe points for emergency stop	2018	A27 A28	Working on conclusion

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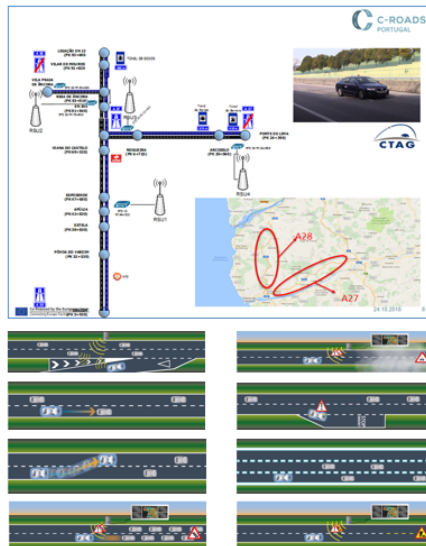
AENL

Use Cases to be tested in 2019

Use Case	Test date	Location of test	Comments
Highway Access	28/02/2019	A27	Conducted tests. Further development needed
Highway exit	28/02/2019	A27 A28	Conducted tests. Further development needed
Behaviour in overtaking	06/2019	A27 A28	
Recommendation of level of automation	06/2019	A27 A28	
Improvements and other use cases	06/2019	A27 A28	

Very intense collaboration between Cintra and CTAG
Contacts have already been established with CTAG, and some trials already made in 2018 (focus on connectivity and automation), the last one 30-10-2018

AAVI

In the process of acquiring and implementing the equipment, for C-ROADS road tests in A22.

	Quarter	Location	Validation date
Installation and Implementation	Q2/2019	A22	06/2019
Field Tests	Q3/2019	A22	09/2019
Communications Tests	Q3/2019	A22	09/2019
Software Tests	Q4/2019	A22	11/2019

Pilot 3 – Network preparation for Connected and Autonomous Vehicles
This pilot overall progressed as expected, with the predicted development being done along the plan.

Pilot 4 – C-ITS Pilot in the Lisbon Urban Node
The pilot setup was delayed due to the public and private procurement processes, namely the need to define the tender specifications.

Pilot 5 – C-ITS Pilot in the Porto Urban Node
The pilot setup was delayed due to the public and private procurement processes, namely the need to define the tender specifications. These processes are longer than expected due to the need to expect for inputs from Activities 3, 4 and 5 and in some cases will take longer than expected.

- Pilot to test a Cooperative Intelligent Transport System (C-ITS) for short-medium term traffic predictions in Porto node
This pilot case aims to demonstrate a Cooperative Intelligent Transport System (C-ITS) to exchange real-time traffic information and to provide short-medium term traffic predictions enabling the traffic management centre (TMC) to react and put in place contingency plans to tackle network bottlenecks and other traffic disruptions.
For this pilot, use cases 1, 2, 3, 4 and 6 are already implemented. Use case 5 is still being implemented. Use case 1 integrates and converts multiple and heterogeneous sources and provides a geographical visualization, including traffic information displayed through colours. Use case 2 analyses the data received to generate warnings of incidents (accidents, works) and of abnormal traffic status. Use case 3 uses data mining and machine learning mechanisms to produce traffic data predictions and displaying them on the map. Use case 4 analyses the data of the produced predictions to generate warnings of future abnormal traffic conditions. Use case 6 provides a mechanism to test "what-if" scenarios in the network in order to more accurately plan roadworks, network improvements, events locations and restrictions or even contingency plans. Summing up, missing is use case 5 (allowing the user to define contingency plans by defining the triggering conditions and the plan itself), further optimizations (model calibration, for instance) and integration tests.

- V2I and I2V integration of a CaetanoBUS vehicle with the infrastructure in Porto node for information and services sharing

The pilot aims at the integration between a CaetanoBUS vehicle with the city's infrastructure in order to exchange valuable information for a more efficient, safe and greener transportation. The main goal for this pilot is to develop a system where a bus is connected to the infrastructure with the new automotive connections technologies. The vehicle will have an OBU that will communicate with a RSU, which, in turn, is connected to the Câmara Municipal do Porto's Traffic Control Centre, and there will also be a link between the vehicle and the Public Transportation Service Provider – STCP through cellular communications. Both endpoints will transmit valuable traffic information and operational data that will be displayed at the driver's dashboard and in an exterior faced variable message sign on the rear windshield.

The services to be deployed are stratified in three levels. In the first scenario there will be a bidirectional communication between the STCP's Fleet Management System (FMS) and the bus's OBU. The second scenario will be a one-way communication between the Traffic Control Centre (TCC), via RSU, and the bus's OBU. The third scenario will have an opposite direction of communication from the second scenario. In a parallel process, both Control Centres, i.e. the TCC and the FMS will have a data exchange endpoint so to be able to share important traffic information as well as operational data.

As these scenarios involve three different major stakeholders, in order for the implementation to be successful, a big share of the workload is related with requirements engineering, namely the analysis and specifications. This is already finished and involved also meetings with CMP, STCP and DMS. At this point, everything is set to start implementing the scenarios and the equipment needed has been bought (OBU and RSUs).

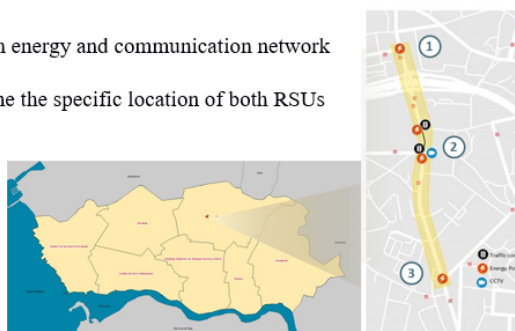Below a schematic representation of the current development status for this pilot activity.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
N/A	794,18	1.688,18	4.695,30	1.177,14

17.   The Swedish Pilot site

The Swedish pilot site is part of the NordicWay2 pilots running in the Nordic countries Denmark, Finland, Norway and Sweden. The main objective of this Action is to deploy pilot studies in order to further develop interoperable Day-1 and Day 1,5 C-ITS services and support infrastructure readiness for connected and automated driving in Denmark, Finland, Norway and Sweden.

NordicWay2 pilots will:

1. Contribute to the harmonisation and interoperability of the C-ITS services in Europe in line with requirements agreed by the C-Roads Platform.

2. Support the deployment of new "Day-1" and "Day-1,5" C-ITS services in Nordic countries and extend its use into vital road freight transport routes subject to extreme weather conditions and in urban and interurban environments.

3. Support the infrastructure readiness for connected and automated driving in Nordic countries in snowy and icy arctic conditions.

4. Assess the socio-economic impacts of the piloted Day 1 and Day 1,5 C-ITS services as well as the effect on users mobility and traffic behaviours and on public acceptance.

The Swedish Pilot covers C-ITS Day-1 and Day-1,5 services within urban and interurban areas

The Swedish pilot covers the design, implementation, test and evaluation of relevant Day-1 and Day-1,5 services within urban and interurban areas. By including a range of operating environments, from city streets to inter-urban motorways, the pilot will have the possibility to assess the viability of different applications on different types of road networks.

The pilot will be based on the use of a set of state-of-the-art passenger cars, public transport buses and heavy goods vehicles which will be equipped with appropriate driver interfaces and connected through clouds by cellular and, for certain applications, ETSI ITS-G5 communication technologies.

The aim of the Swedish pilot is to demonstrate the possibility to communicate between vehicles, infrastructure and clouds and to show the interoperability, scalability and flexibility of the NordicWay interchange network with connected clouds. This will be shown by testing Day-1 and Day-1,5 services.

C-ITS Day-1 services:

- Connected Traffic Signals including:
    - Traffic signal priority request by designated vehicles (TSP)
    - Green Light Optimal Speed Advisory (GLOSA)
- Hazardous Location notification (HLW) including:
    - Roads works warning (RWW)
    - Emergency vehicle approaching (EVA)

C-ITS Day-1,5 services:

- Controlled Zones: Dynamic environmental zone
- Connected & Cooperative navigation into and out of the city (CCN): Access control to designated infrastructure

Involved partners

The Swedish Transport Administration and the following public and private organisations:

- Telefonaktiebolaget LM Ericsson
- Scania CV AB
- Volvo Car Corporation
- City of Gothenburg
- City of Stockholm
- VOLVO AB
- Kapsch TrafficCom AB
- Uppsala kommun
- Zenuity AB
- Swarco Sverige AB
- Technolution AB
- Springworks AB
- Carmenta AB
- Statens Väg och Transportforskningsinstitut

Location

The pilot is cellular based and will thus be functional in most parts of Sweden as well as Norway, Finland and Denmark where the services are applicable. The Swedish pilot focuses on C-ITS piloting in the cities of Gothenburg, Stockholm, Södertälje and Uppsala including their access routes E6, E4, E20, E18 and RV40 which are all included in the Core Network and part of the Scandinavian – Mediterranean CEF corridor.

Overview of progress by End of 2018

During 2017 two workshops and bi-weekly meetings were held between Trafikverket (Swedish Transport Administration) and the Swedish implementing bodies. The objective was to specify and define the C-ITS Pilot services, the number of vehicles, and the roles and responsibilities of the Swedish implementing bodies. This work was the basis of the the Swedish Pilot plan which specifies amongst others active industry involvement of the implementing bodies in all services piloted.

In 2018 the work in the Swedish pilot has focused on Pilot Planning (Milestone 35, due end of September 2018) as well as preparing for Milestone 36 (Upgrade of the Swedish Traffic Cloud, due in February 2019). The work in the Swedish pilot is divided into ten tasks and each of these are progressing according to plan. The work is coordinated by bi-weekly meetings on Skype or face-to-face. For the services to be implemented focus has been on service definition and aligning services with C-Roads as well as the technical implementation.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	140	1.500	2.300	2.300

18. The Spanish pilot site

The pilot report is meant to introduce the pilot sites foreseen in C-Roads Spain, as well as their services and technologies. C-Roads consists of different C-Roads pilots operated in different national environments, being Spain one of their pilot sites' locations.

The Spanish pilot is made out of five different pilots, each of them with their unique set of technologies and C-ITS services, and with the involvement of different partners. This heterogeneity is meant to cover a wide spectrum of use cases, for the sake of assessing the impact of connected mobility in many representative scenarios. In this sense, the effective execution of the piloting phase depends on an accurate ex-ante scheduling and definition of evaluation methodology. This set of pilots have been carefully chosen in order to verify interoperability at national and European level, as well as the added value of C-ITS services in different scenarios.

Involved partners

A multidisciplinary group of partners is involved in the execution of tests:

- Public authorities:
  - Dirección General de Tráfico – Ministry of Interior (DGT).
  - Dirección General de Carreteras - Ministerio de Fomento (DGC).
  - Madrid Calle 30 S.A.
- Associations:
  - Foro de Nuevas Tecnologías en el Transporte (ITS España).
  - Asociación Clúster de Movilidad y Logística de Euskadi (MLC ITS EUSKADI).
- Private companies:
  - Transport Simulation Systems SL (TSS).
  - Equipos de Señalización y Control (ESYCSA).
  - Indra Sistemas S.A. (Indra).
  - Grupo Mecánica del Vuelo Sistemas S.A.U. (GMV Sistemas).
  - Opus Remote Sensing Europe (OPUS RSE).
  - Gertek Sociedad de Gestiones y Servicios S.A. (Gertek).
  - ICEACSA Consultores, S.L.U.
  - Ingartek Consulting, S.L.
  - Abertis Autopistas España S.A.
  - Automóvil Club Asistencia S.A. (ACASA).
  - SenseFields S.L.
  - Ferrovial Corporación S.A.
  - Kapsch TrafficCom Transportation S.A.U.
  - SEOPAN, Asociación de empresas constructoras y concesionarias de infraestructuras.
- Universities:
  - Universidad Politécnica de Madrid (UPM).
  - Universitat Politècnica de Catalunya (UPC).
  - Universitat de Valencia – Estudi General (UVEG).
- Research Centres:
  - Fundación para la Promoción de la Innovación, Investigación y Desarrollo Tecnológico en la Industria de Automoción de Galicia (CTAG).
  - Asociación Centro Tecnológico Ceit-IK4.

- Regional authorities:
  - Council of Vigo city.
  - Diputación Foral de Bizkaia - Bizkaiko Foru Aldundia.

Location

The five Spanish pilots are the following:

- **DGT 3.0**, located along the overall road network in Spain with an extension of approximately 12,270 Km. It will be deployed using cellular-based communication technologies (3G and 4G/LTE).
- **SISCOGA Extended**, comprehending the extension of an existing test site infrastructure located in the city of Vigo and its metropolitan area already prepared to test ITS-G5 communication technology. It will span 150 Km.
- **Madrid Calle 30**, located along the road "Calle 30" in Madrid, with approximately 32 km. C-ITS services will be deployed using hybrid communication technologies.
- **Cantabrian pilot**, deployed along approximately 75 km at the north of Spain using hybrid communications.
- **Mediterranean pilot**, deployed along approximately 125 km at selected road sections located in Catalonia and Andalusia using hybrid technologies.
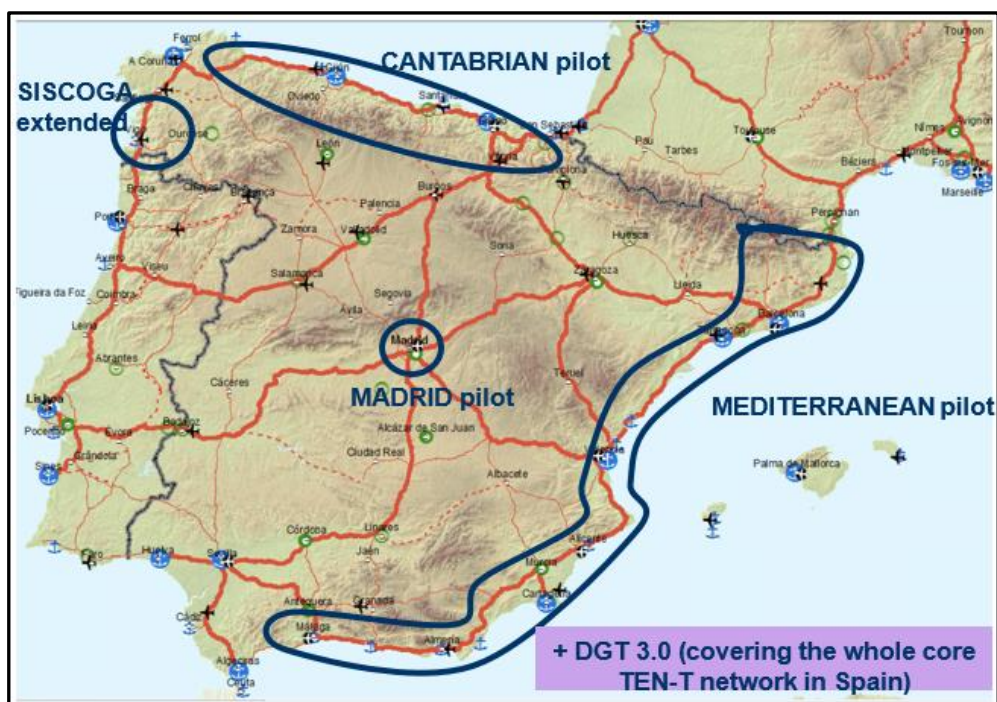

Figure 18: Location of the Spanish pilot site

Overview of progress by End of 2018

Within the Spanish pilot a series of Steering Committee and General Assembly meetings (27th February, 29th May, 15th of November) have been held. Governance and technical involvement has been endorsed, and roles and responsibilities have also been slightly updated according to the course of action and the latest activities carried out by the C-Roads Platform. These meetings have resulted in an improved collaboration, a coordinated effort, and a unified position towards the C-Roads Platform. From the technical point of view, in these meetings the technical setup of the Spanish local pilots has been outlined and, following their setup and deployment, their progress has been managed.

The Spanish pilot is currently in the 1st phase. After the preliminary tests and studies performed in each subpilot, and provided that TF2 and TF3 have finally delivered some set of functional and technical specifications for the ITS-G5 communication scenario, the piloting phase has started with the deployment and update of the test sites and fleet, and vehicle data has been collected:

- The DGT 3.0 pilot has witnessed the start of the technical implementation of the DGT 3.0 platform, after concluding the tendering process in April 2018. An initial set of services has reached pre-production and been provided to the involved partners. During the first half of 2019 it is expected to reach a high level of convergence with the services described by the Platform and listed in the C-Roads Spain's Grant Agreement.
- The SISCOGA Extended pilot achieved the full deployment of the roadside equipment (all of it at interurban areas) and most of the fleet foreseen for the pilot has been properly adapted, which includes police cars, fire fighters, buses, taxis, and particular vehicles. The baseline has been established, and the first data corresponding to urban and interurban journeys have been collected.
- The Madrid Calle 30 pilot started its operation according to the predefined schedule, with part of roadside equipment being deployed. Most of the fleet was adapted and started to collect data in due time. Complementary emissions-sensing and traffic-simulation tasks started in late 2018 in order to enrich the data.
- The Mediterranean pilot has witnessed the deployment of most of the foreseen technical resources. In that regard, roadside equipment and vehicle fleet have been deployed, and two new Traffic Management Centres have been implemented and are undergoing the corresponding tests. Nevertheless, despite the deployment is not fully complete the pilot has started the collection of traffic data in mid-2018 as planned. It is expected that the deployment will be complete during the first half of 2019.
- The Cantabrian pilot achieved the adaptation of all public and most weather-sensing vehicles during 2018, and it is expected that the rest of the fleet (including particular fleets) will be ready during the first half of 2019. Additionally, more than 30 RSUs have been deployed covering 75 km of interurban sections, and the initial services described by the C-Roads Platform have been implemented.

The evaluation phase will be additionally supported by the results obtained by the Working Group 3 of the Platform concerning the selected KPIs and evaluation methodology for each investigation area, which have been endorsed and implemented by the Spanish pilot.

Indicative budget overview (in k€)

2016	2017	2018	2019	2020
0	1.546	7.751	5.428	3.254

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19. Summary

Based on technical specifications developed in 2018, pilot sites have defined their use cases they intend to deploy, and the precise sections to be equipped. Active participation of dedicated platform partners on national and international preparatory works for public procurements, deployment and integration of C-ITS system has been carried out. First tender for ITS-G5-based C-ITS roll-out on European roads has been issued.

To ensure interoperability of services, it is important to carry out cross-border tests. Therefore, in 2018, cross-border tests were conducted, meaning that vehicles were tested on foreign pilot sections in Europe. Cross-tests were conducted in Reims, Kent, Helmond, Frankfurt and Vienna.

Member State	2016	2017	2018	2019	2020
Austria	446,15	1.184,72	1.846,86	13.172,27	1.600
Belgium/Flanders	20	560	1.670	1.680	540
Czech Republic	128,61	829,63	1.970,27	10.679,30	2.170,12
France	716,48	279,69	266,75	3.527,22	1.673,62
Germany	724,9	1.492,6	2.091,6	2.876,6	2.426,3
Netherlands	1.100	3.700	5.200	3.300	0
Slovenia	154	172	555	1.999	5.416
UK	39,8	1.190,8	4.397,0	5.972,6	423,2
Belgium/Wallonia	-	18	208	2.424	1.678
Denmark	-	50	130	240	240
Finland	-	2.300	1.300	1.400	620
Hungary	-	0	26,1	590	1.380,3
Italy	-	2.238,99	6.123,41	12.966,11	20.864,03
Norway	-	1.700	1.500	1.650	750
Portugal	-	794,18	1.688,18	4.695,30	1.177,14
Sweden	-	140	1.500	2.300	2.300
Spain	-	1.546	7.751	5.428	3.254
Sum	**3.329,94**	**18.196,61**	**38.224,17**	**74.900,4**	**46.512,71**

Figure 19: Indicative budget overview (in k€)