C-ROADS

Detailed pilot overview report

(Detailed pilot description and demonstration plan/ Detailed pilot partner and structures description)
Vienna, December 2017, v1.0

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Detailed pilot overview report
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description)

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1. Introduction

The pilot report should give an overview of the planned C-Roads pilot sites and their services and technologies covered. C-Roads consists of different C-Roads pilots operated in different national environments.

In order to achieve deployment, the members of the national pilots define the test procedures and steps but also the single outcomes of the tested applications in the mobile and fixed C-ITS units, resulting in a set of common parameters for all pilot sites. The test procedures are verified and cross checked with remote laboratory tests between the different pilots in the EU in order to display differences of C-ITS parameters early in the process. The respective locations are selected according to their suitability to distribute C-ITS test messages for validation purposes, but also for a later link with live data streams from the TMC to enhanced Day-1-C-ITS-services. The additional technical C-ITS element that will be specified and implemented is a first version of a C-ITS security solution in cooperation with the public and private stakeholders involved in the management of the C-ITS Network.

While all different European C-Roads-Pilots finally will be operated in their specific Member States and regions, they all have committed to regard the European dimension of the whole action and hence to deploy their C-ITS pilot infrastructure in a way to enable harmonised services to end-users. This harmonisation work will be coordinated through cooperation in the C-Roads platform, where all C-Roads Member States are committed to contribute to.
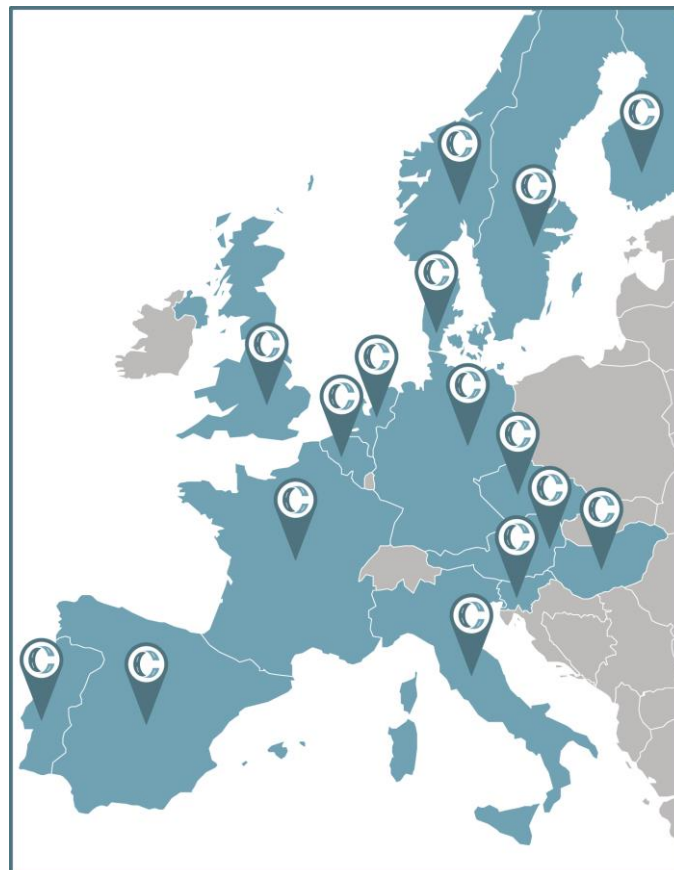
Figure 1: C-Roads pilot sites

2. The Austrian Pilot site

Pilot overview

The Austrian pilot contributes to interoperable European C-ITS solutions starting from the EU 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 EU 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.

There is already a pilot area ("Living Lab") in place with a total of 19 C-ITS stations, with an infrastructure operational and open for stakeholders. Consequently, there has already been active participation of stakeholders from the automotive industry within 6 test cycles of the ECo-AT-Corridor.

Following up on this, there is a C-ITS Masterplan (till 2020) in place for a roll-out to the major parts of the 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, Day 1.5 etc.)
- Common quality assurance
- Common development towards "Automated Driving"

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Location

C-Roads Pilot Sites in Austria
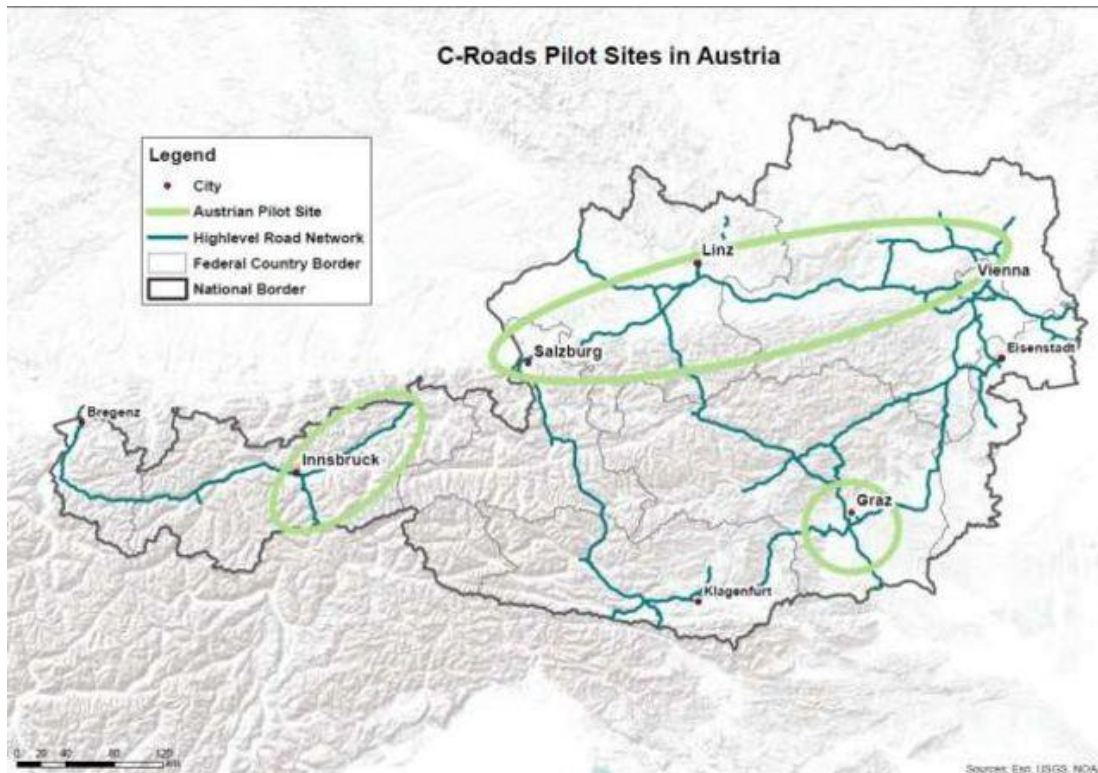
The Austrian C-Roads pilot site covers several different areas of heavily frequented motorway networks:

- 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, will be one of the first C-ITS areas with several C-ITS installations, mainly concentrating on traffic sensitive hotspots along the way
- The motorways around the city of Graz will also receive a number of C-ITS installations. At that particular site, C-ITS will also will part of the test track for automated driving established there by the ALP.Lab consortium.
- Based on an analysis of traffic flows and accident rates, selected hotspots (around e.g. Innsbruck, Wiener Neustadt, Vöcklabruck) not covered by the other installations will also receive selective C-ITS coverage.

Involved partners

Pilot activities at single test and validation locations are prepared by the Austrian motorway operator ASFINAG. In most cases, the locations will be gantries where C-ITS units are installed and can be accessed without restrictions to passing by traffic flows of vehicles. Additional mobile road side units are planned e.g. on road works warning trailers.

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Services and technologies covered by the Austrian pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Austrian Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Austrian Pilot site			X	X	X	X	X	X	X	X				

Schedule

The schedule started from the availability of an agreed EU C-ITS security solution ready for implementation and validation in 2017. Event before that, the "Living Lab" established in ECo-AT has made 24 operational ITS-G5 based C-ITS installations available, covering more than 50 kilometers of the motorways around Vienna.

From 2018on, the "Living Lab" installations will be updated and a variety of additional ITS-G5 Road Side Units will be installed and connected to the central C-ITS-station with live traffic data feeds from the Traffic Management Centre (TMC).

The Austria C-Roads pilot site becomes operational throughout 2018, covering more than 300km of Austrian motorways altogether, with the aim of having first C-ITS deployments on nearly all traffic sensitive areas on the Austrian motorway network.

From early 2019 onwards, cross-site tests can be carried out on these C-ROADS pilot locations.

Demonstration plan

The Austrian C-Roads-Pilot consists of four project phases, for which also performance indicators are defined. These start with the core elements of the EU C-ITS Corridor project in Austria (ECo_AT) and lead to a motorway based network of C-ITS stations in 2020.

1. First, in the specification phase of Day-1-C-ITS-services, partners in the national pilots work on specifications of common C-ITS services and harmonise them with other C-Roads national pilots in Europe.
2. In 2018 piloting and cross-site testing, including a common C-ITS security solution, will be implemented in the C-ITS stations.
3. 2019 will see the start of regular pilot operation and live data feed from the TMC in single areas.
4. By 2020 network segments-wide C-ITS operation including access to vehicle data and enhanced message distribution to all travellers on the road will take place.

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3. The Belgium (Flanders) Pilot site

Pilot overview

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.

Location

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.

Implementing bodies

Flemish Department of Mobility and Public Works
Tractebel Engineering SA
ITS Belgium
HERE Technologies

Services and technologies covered by the Belgium (Flanders) pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
BE (Flanders) Pilot site		x			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
BE (Flanders) Pilot			x	x		x	x		x		x			

Schedule

Planned timeline:

- Q1/2017 - Q2/2018: Use case definitions, requirements, analysis and development

- Q3/2018 - Q4/2018: System set-up, fine-tune, testing & verification, driver acquisition & promotion

- Q1/ 2019: test drives, making use of a trusted fleet

- Q2/2019 - Q4/2019: System is operational

- Q2/2019 - Q3/2020: Evaluation

Demonstration plan

Planned Deliverables:

- Selected C-ITS use cases to be supported via the HERE Cloud

- an application enabling road users to provide input

- a web-based user interface for the Traffic Management Centre

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- guidance for/ assistance of test drivers including collection of feed-back will be set up and operated through a dedicated web-based application

- Test site in operation

- Summary report on the operations performed and lessons learned

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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" on the Prague ring road (D0) and small parts of motorways D5 and D1. 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 provided via hybrid ITS G5 / LTE system 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 and LTE-B will be tested within this pilot operation. C-ITS services will be provided via hybrid ITS G5 / LTE (or/and LTE-V, LTE-B) 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 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 pilot will be deployed on 2 level railway crossings. Both will be equipped with security systems where one is equipped with barriers and one is 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.

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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.

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 southern part of 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 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, 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 interlocking and security signalling systems (one with- and one without barriers).

- **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.

Geographical representation of each Deployment & Test site as described above:
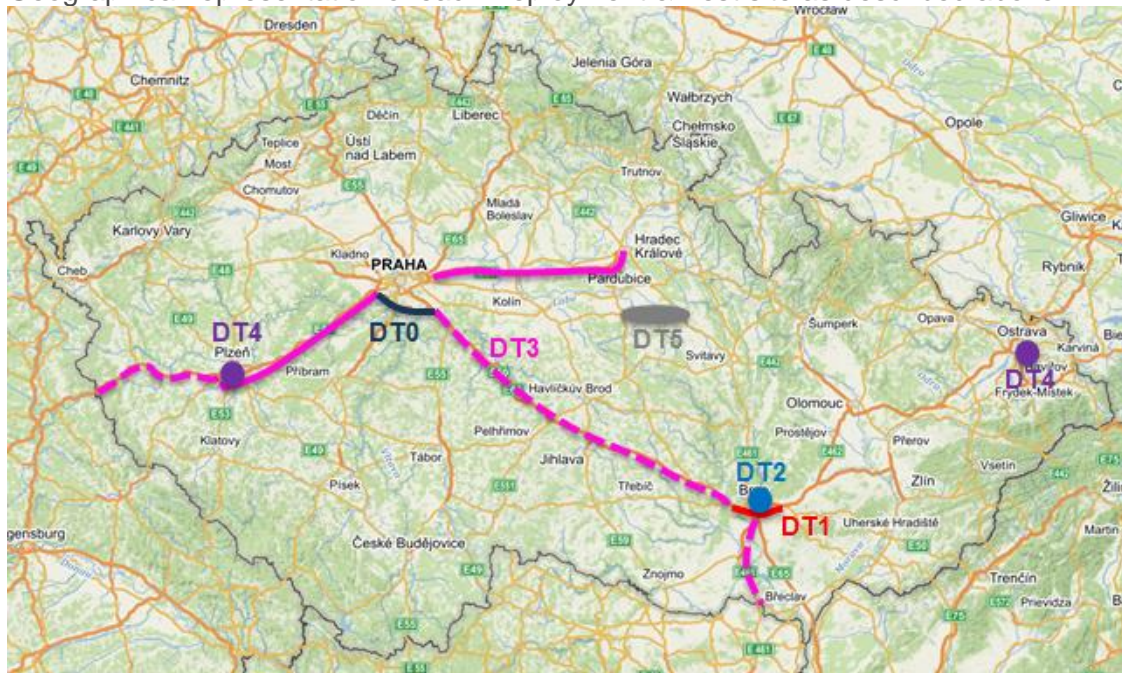
Implementing bodies

Implementation of C-ITS services within C-ROADS CZ project will be done by the following bodies:

- Deployment of C-ITS services via ITS G5
    - Road and motorway Directorate (RSD) of the Czech Republic
    - City of Brno (via. Brněnské komunikace)
    - Správa Železniční Dopravní Cesty of the Czech Republic (SŽDC)
    - City of Ostrava a Plzeň (via. their public transport companies)
    - 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)

Services and technologies covered by the Czech pilot

C-ROADS CZ project partners will deploy hybrid communication based on ITS G5 and cellular technologies. The deployment of hybrid communication is expected in the following steps:

- The first step is the use of existing standardized ITS G5 as a base stone for C-ITS services provision and supplement the coverage by current (existing) technologies in cellular network represented by state of the art – LTE (4G). It will be investigated what cellular technology / protocols will be the most appropriate for C-ITS messages transfer.
- Next step is the extension of communication used in the first step for testing / evaluation of performance of new cellular technologies as e.g. LTE-V or / and LTE-B. These technologies should be tested within DT3, which covers D1, D5 and D11 motorways connected via D0 motorway.
- The security aspects of Czech pilot implementation will be fully in compliance with the recommendations of C-Roads TF1 group in order to guarantee that pilot implementation will be interopable. The security parameters will be also tested by CTU.

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Czech Pilot site	X	X			X

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Czech Pilot site	X	X	X	X	X	X	X	X	X	X			X	X

Within C-ROADS CZ a detailed Use case catalogue covering all use cases and their respective scenarios have been developed. The use cases to be implemented within the C-ROADS CZ project are:

- Road works warning
- In-vehicle information
- Probe Vehicle Data
- Slow and stationary vehicles
- Emergency vehicle approaching
- Traffic jam ahead warning
- Intersection signal violation
- Public transport preference
- Hazardous location notification
- Weather conditions warning
- Railway level crossing
- Public transport safety
- Electronic emergency brake lights

C-ROADS CZ members are closely following C-ROADS Platform WG2 activities where harmonization of Use cases takes place, and the final version of the use case catalogue will be adjusted according to the final use case release from WG2 TF2.

Schedule

C-ROADS CZ consortium has defined initial time plan for DT deployment as follows:

2017 Q2 – DT 1 public tender launch
2018 Q1 – DT 2, DT3, DT4 and DT5 public tenders launched / deployment
2018 Q4 – DT 1, DT 2, DT 3, DT 4 and DT5 will be deployed and fully operational
2019 Q3 – DT 6 will be ready for operation
2020 Q2 – Evaluation completed for all DTs
2020 Q4 – All DTs completed

Demonstration plan

Demonstration plan is being currently developed. There is an expectation that C-ROADS CZ will create an open platform which will allow demonstration of all deployed C-ITS technologies and use cases.

In parallel C-ROADS CZ consortium has developed and agreed initial draft of the National dissemination plan, which is focusing on sharing project results and gaining knowledge with experts and broad public.

There is a minimum demonstration plan for each DT defined by its location, duration, technology deployed, partners involved and use cases implemented. Following technology and use cases of each DTs are envisaged:

- **DT1 – Brno agglomeration** is expected to consist of a minimum of 15 roadside units (RSU) deployed at RSD's infrastructure, together with at least 20 on-board units (OBUs) installed in maintenance vehicles / trailers of RSD, and min. 5 equipped vehicles from

project partners (including associated partners) will be used for testing. The C-ITS equipment will be connected to the C-ITS back-office of RSD.

At least the following services will be deployed:
- o Road works warning
- o Probe vehicle data
- o In-vehicle signage
- o Slow or stationary vehicle(s)

The communication technology used will be at least ITS G5 and existing cellular technology.

- **DT2 – Brno city;** at least 10 OBUs will be installed in maintenance vehicles of the city road operator (BKOM), and at least 5 equipped vehicles from project partners (incl. associated partners) will be used for testing. At least 10 roadside units (RSUs) will be deployed at intersections by connecting to the traffic light controllers. In addition, C-ITS back-office will be established within the existing BKOM traffic control center. The back-office will concentrate all data from the C-ITS infrastructure in the city, control and operate the C-ITS equipment, and share certain data with the national C-ITS back-office run by RSD.

At least the following services will be deployed at this site:
- o Probe vehicle data
- o Emergency vehicle approaching
- o Signal violation / Intersection safety
- o Weather conditions

The communication technology used will be at least ITS G5, whereas cellular network is considered to be tested as well as the pilot site is integrated into Brno agglomeration test field.

- **DT3 – Motorways D1, D5, D11 and I/52 / D52;** a minimum of 50 RSUs at the roadside and 90 OBUs will be installed in maintenance vehicles / trailers of RSD and min. 5 equipped vehicles from project partners (including associated partners) will be used for testing. The C-ITS equipment will be connected to the C-ITS back offices of RSD and mobile operators.

At least the following services will be deployed on the site:
- o Road works warning
- o Probe vehicle data
- o In-vehicle signage
- o Slow or stationary vehicle(s)
- o Emergency vehicle approaching
- o Traffic jam ahead warning
- o Weather conditions

The communication technology used will be ITS G5 and existing cellular technologies supported by new cellular LTE-V and/or LTE-B technologies.

- **DT4 – Public transport deployment in cities of Ostrava and Plzen** where C-ITS services will also be tested in the public transport sector where at least 3 OBUs will be temporarily installed in public transport vehicles in each city and at least 2 RSUs will be used for testing in each city. Common new C-ITS back office will be developed to serve

new use cases in both cities.

At least the following services will be deployed at this site:
- o Public Transport Preference
- o Public Transport Safety
- o Hazardous Location Notification

The communication technology will be ITS G5 along with existing cellular technologies.

- **DT5 – Railway crossing pilot,** it is expected to install at least 2 RSUs on security signalling systems in close distance to the railway crossing and min. 2 OBUs will be used for the railway crossing deployment and subsequent field testing. New C-ITS back office will be developed for this purpose and will be used for both testing locations.

At least the following services will be deployed at this site:
- o Railway Level Crossing
- o Hazardous location notification

The communication technology will be ITS G5 along with existing cellular technology.

- **DT6 – Cross border testing,** following the national field tests the consortium will align with the international C-Roads Platform to carry out international cross-testing and cross-border tests. On these sites the functionality of the C-ITS hybrid systems will be tested when crossing the state borders in terms of interoperability, data exchange between back offices and traffic control centers of two member states, as well as issues related to interoperability of telco operators (roaming etc.)

Additionally C-ROADS CZ partners' (including SKODA AUTO) vehicles will be equipped with hybrid OBUs for the purpose of cross testing between each DT's within the C-ROADS CZ project and those vehicles will be offered for larger C-ROADS Platform testing as well.

In order to secure interoperable operation between each Deployment & Test locations and C-ITS back offices deployed, the so-called Integration platform will be developed and deployed within the C-ROADS CZ project. This will ensure common communication structure and rules for data exchange for each use case between project partners.

5. The French Pilot site

Pilot overview (C-Roads France)

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.

Location

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

Services and technologies covered by the French pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
French Pilot site	X	X			X

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
French Pilot site	X	X	X	X	X	X	X	X		X		X		

Schedule

2016-2020

Demonstration plan

A first demonstration based on existing SCOOP@F services on a new pilot site has taken place at the European ITS Congress in Strasbourg.

A final demonstration with the new services deployed will be organized for the C-ITS Road show in June 2020.

Additional demonstrations might be organized in between.

Pilot overview (InterCor – French part)

InterCor aims to streamline C-ITS implementation in 4 member states linking the different national initiatives towards a harmonized strategic rollout and common specification. C-ITS pilot sites to communicate data through cellular and/or ITS-G5 networks will be installed in the Netherlands, Belgium, UK and France, for operation and evaluation of "Day-1" services as recommended by EC "C-ITS platform".

Location

Involved partners

ROAD OPERATORS	−Ministry: public road operators (DIRs Nord, Ile-de-France) −SANEF
LOGISTICS EXPERTS	−I-Trans −Gyptis −Geoloc Systems
RESEARCH INSTITUTES	−IFSTTAR
UNIVERSITIES AND HIGHER EDUCATION AND RESEARCH INSTITUTIONS	−Université de Valenciennes −Université de Reims Champagne-Ardennes −Institut Mines Télécom (Telecom ParisTech)
SECURITY EXPERTS	−IDnomic

Services and technologies covered by the French pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
French Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
French Pilot site	X	X	X	X	X	X	X	X		X		X		

Schedule

2016-2019

Demonstration plan

The demonstration plan of InterCor is based on 4 TESTFESTs meant to approve the common specifications among the 4 countries involved

- one on ITS G5
- one on hybrid commnications
- one on security
- one on new services.

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

Pilot overview

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 Hessian and Lower Saxony 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 Lower Saxony C-ITS Pilot will contribute to the C-Roads cooperation by implementing and deploying the following three C-ITS services:

- Slow or Stationary Vehicle Ahead Warning Service Deployment (SSVW)
- In-Vehicle Information/In-Vehicle Signage Service Deployment (IVI/IVS)
- Probe Vehicle Data Service Deployment (PVD)

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

- Roadworks Warning Service Deployment (RWW) (extension of the existing service for long-term roadworks)
- Slow or Stationary Vehicle Warning Service Deployment (SSVW)
- Emergency Vehicle Approaching Service Deployment (EVA)
- 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)

Location

The seven so called Day One Services are trialled in the German testbeds in Lower Saxony (motorway A2 near Brunswick, see **Figure 2**) and Hessen (DRIVE-test field Hessen for connected automated traffic around Frankfurt, see **Fehler! Verweisquelle konnte nicht gefunden werden.**).

In Lower Saxony, 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, Labor and Transport of Lower Saxony (Niedersächsisches Ministerium für Wirtschaft, Arbeit und Verkehr (MW)) and the German Aerospace Center (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 Lower Saxony 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.
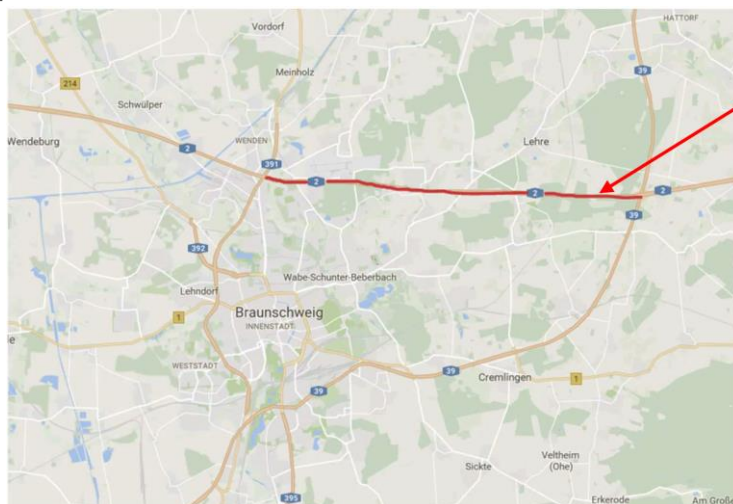
Figure 2: Overview of the test field of the C-ITS Pilot Lower Saxony[1]

The activities of the Hessian 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

Furthermore, the GLOSA service will be implemented on national roads in two cities in the Rhine-Main region (marked with rectangles in **Figure 3**).

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[1] Source of the map: © 2017 GeoBasis-DE/BKG (©2009).Google
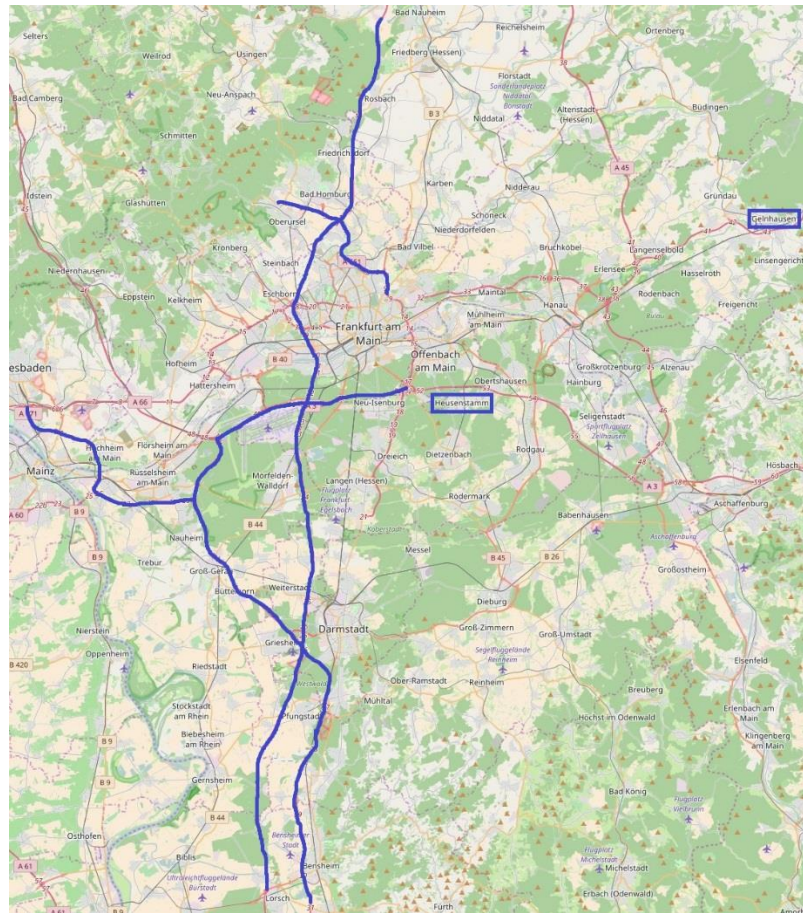
Figure 3: Overview of the test field of the C-ITS Pilot Hessen [2]

Implementing bodies

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 Lower Saxony pilot site the two companies NORDSYS and OECON Products & Services are responsible for the local activities. They will be supported by the associated partner DLR.

Full list of consortium members:
- ITS automotive nord GmbH
- Federal Highway Research Institute
- Hessen Mobil – Straßen- und Verkehrsmanagement
- Continental Teves AG & Co. oHG
- SWARCO Traffic Systems GmbH
- AVT STOYE GmbH
- GEVAS software Systementwicklung und Verkehrsinformatik GmbH
- Heusch/Boesefeldt GmbH
- Bayerische Medien Technik GmbH
- Hessen Digital Radio GmbH
- Garmin Würzburg GmbH
- NORDSYS GmbH
- ESCRYPT GmbH – Embedded Security

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[2] Source of the map: OpenStreetMap-participants, Hessen Mobil, CC-BY-SA 2.0

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- INGENIEURGESELLSCHAFT FUER AUTO UND VERKEHR GMBH
- e-Shuttle GmbH
- Niedersächsisches Ministerium für Wirtschaft, Arbeit und Verkehr
- OECON Products & Services GmbH

Services and technologies covered by the German pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
German Pilot site	X	X	X		

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
German Pilot site		X	X	X		X		X		X	X	X		

Schedule

Lower Saxony

The schedule starts with the preparation of a concept and tools for the deployment of C-ITS services in Lower Saxony which is an ongoing and dynamic task for the whole project duration. By the end of 2018 the first SSVW service will be implemented. Subsequently, IVI/IVS and PVD services will be implemented by the end of 2019. For 2020, it is planned to publish a C-ITS preparation report for the future deployment of C-ITS-services.

Hessen

In Hessen, the PVD service will be integrated into all other services and operational by the end of 2018. Thus, all implemented R-ITS-S of the Hessian pilot will be used for this service.

The existing short-term RWW will be extended by long-term RWW, SSVW and EVA. In 2019, four R-ITS-S for long-term roadworks and four R-ITS-S for short-term roadworks equipped on warning trailers will be provided for the operation. For SSVW and EVA, five road maintenance service and emergency vehicles will be equipped with ITS Vehicle Stations (V-ITS-S).

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The deployment of SWD and TJW will start in the second half of 2018 and will be operational with 14 R-ITS-S for TJW and 15 R-ITS-S for SWD in 2020. For GLOSA, a smartphone app already exists for Android. A Traffic Light Control Centre and 12 R-ITS-S for the traffic lights will be implemented and operational in 2020. For the integration and demonstration of the incoming information into the ACC, four test vehicles will be available.

Comprehensive testing, evaluation and assessment will follow as a task after the deployment of all aforementioned services.

Demonstration plan

Lower Saxony

By the end of 2019, the entire ITS system in Lower Saxony with three services (SSVW, IVI/IVS and PVD) should be operational and ready for demonstration. The demonstration will be held until 30.09.2020. The following deployments will be demonstrated:

- o The established infrastructure with one virtual TMC, one data converter system and one Central-ITS-Station (C-ITS-S) between Roadside-ITS-Station (R-ITS-S) & virtual TMC.
- o Three R-ITS-S, which should be mounted on gantries and/or SOS call boxes and built up with an appropriate outer casing (like waterproof, lightning protection, dustproof and suitable for strong temperature fluctuations etc.).
- o Two V-ITS-S, which send and receive traffic data and
- o Three new operational services (SSVW, IVI / IVS and PVD).

To demonstrate the services, test vehicles are needed. The IAV test vehicles and the vehicles from E-shuttle should be organized, equipped and ready for demonstration.

Hessen

In Hessen, RWW, SSVW and PVD should be operational and ready for demonstration in the end of 2018, whereas the development and deployment of GLOSA, TJW and SWD will be finished one year after. The following deployments, which will be demonstrated, are listed below:

- o the established infrastructure with one Central-ITS-Station (C-ITS-S), a PKI Server, Traffic Light Data Server and a Traffic Light Control Centre
- o 29 R-ITS-S mounted on gantries
- o 12 R-ITS-S mounted at traffic lights in Heusenstamm and Gelnhausen
- o four R-ITS-S, which are temporary stationary while a long-term roadwork
- o four mobile R-ITS-S equipped on warning trailers as well as the ones of the project *C-ITS Corridor*
- o four V-ITS-S for road maintenance service and one for an emergency vehicle
- o four V-ITS-S, which send PVD and receive information from other vehicles and the R-ITS-S
- o one smartphone application for the service GLOSA
- o four new operational services (SSVW, TJW, SWD and GLOSA)
- o two service extensions (RWW and PVD)

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.

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.
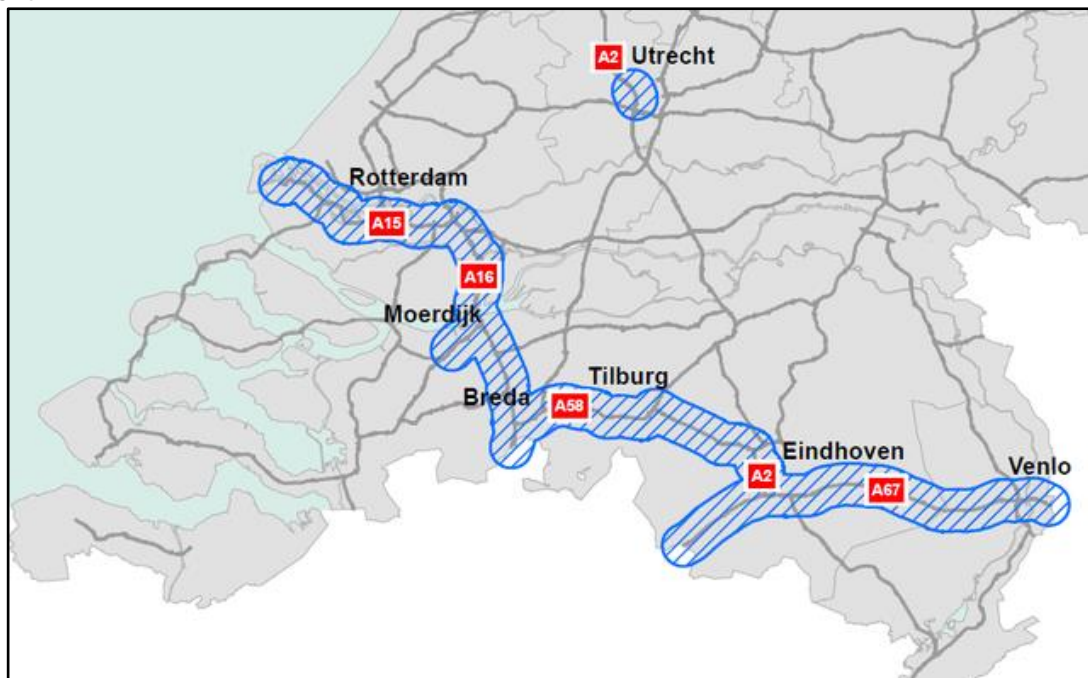
Figure 4: Location of the Dutch pilot site

Implementing bodies

The project coordinator is the Dutch Ministry of Infrastructure and Watermanagement; the daily management will be done by the Test site Project Management Team. Furthermore Province of Noord Brabant and Province of Utrecht are involved.

Services and technologies covered by the Dutch pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Dutch Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Dutch Pilot site						X		X		X		X		

The services Road Works Warning (RWW), Probe Vehicle Data (PVD) and In Vehicle Signage (IVS) will be tested and implemented in the pilot area. The services RWW and IVS will be realized, not only by ITS G5 communication, but also by cellular communication and/or by a combination of both types of communication. On several locations in the Province of Noord-Brabant (around Eindhoven and Helmond) the service Green Light Optimal Speed Advice (GLOSA) will be implemented, also using both types of communication (hybrid solution).
Four use cases of the logistic service MCTO (Multimodal Cargo Transport Optimization) will be tested and implemented.

Schedule

The project's schedule follows the usual path: use case definition, specification, development, validation and evaluation, however in an iterative process until deployment. Pilot sites are expected to be ready for driving by the end of 2019, road shows are planned for 2020

The Dutch pilot activities are executed in close cooperation of the C-ITS corridor with the partners from Germany and Austria and Intercor, which is expected to have its pilots operational by end 2018.

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Demonstration plan

Use Case	Pilot description
Roadworks Warning **ITS G5 communication, mobile solution with safety trailer;** **November 2016**	− Pilot on motorway A16, south of Rotterdam (complicated road lay-out with fly-overs and parallel carriageways); − Roadworks with one lane closed on the right side, secured by a road safety trailer; − Regular traffic conditions, roadworks only between 10:00 and 15:00 (in peak hours no roadworks allowed); − Road safety trailer equipped with RSU and communication to a back-office; − RSU on road safety trailer sending a warning (DENM) via ETSI G5 to the approaching traffic; − Two equipped test vehicles driving on this stretch of road continuously between 10:00 and 15:00, to receive the warning; − Analysis of all logged data to determine the performance.
Probe Vehicle Data **December 2016**	− Pilot on motorway A58, between Tilburg and Eindhoven; − 35 RSUs with communication to a back-office; − 50-100 equipped vehicles (ETSI G5 and cellular communication); − Vehicles equipped with ETSI G5 sending CAMs to the RSUs; − Comparison of the data from the vehicles with data from the loop detectors; − Analysis of all logged data to determine the technical performance.
Roadworks Warning / In-vehicle Signage **March 2017**	− Pilot on motorway A16, south of Rotterdam (complicated road lay-out with fly-overs and parallel carriageways); − Regular traffic conditions, roadworks only between 10:00 and 15:00 (in peak hours no roadworks allowed); − Situation with real roadworks; − 5 fixed RSUs on gantries connected to a back-office; − RSUs sending two types of messages via ETSI G5: DENMs to indicate the position of the roadworks (RWW) and IVI to indicate the information on the variable message signs on the gantries (IVS - variable speeds or red crosses); − Three equipped test vehicles driving on this stretch of road continuously between 10:00 and 15:00, to receive the warnings; − Analysis of all logged data to determine the performance.
TESTFEST **Roadworks warning In-vehicle Signage Probe Vehicle Data** **July 2017**	− Tests on the parking near a maintenance station and on motorway A16, near Dordrecht, south of Rotterdam (complicated road lay-out with fly-overs and parallel carriageways); − Regular traffic conditions, roadworks only between 10:00 and 15:00 (in peak hours no roadworks allowed); − Situation with real roadworks; − 13 fixed RSUs on gantries and a fully automatic connection to a back-office; − RSUs sending two types of messages via ETSI G5: DENMs to indicate the position of the roadworks (RWW) and IVI to indicate the information on the variable message signs on the gantries (IVS - variable speeds or red crosses); − Three equipped test vehicles from Rijkswaterstaat driving on this stretch of road continuously between 10:00 and 15:00, to receive the warnings; − Interoperability testing with OBUs from partners in the InterCor project; − Interoperability testing with OBUs from C-ROADS partners, Car-2-Car Communication Consortium members and others who participated, 15 in total. − Analysis of all logged data to determine the performance.
Roadworks warning In-vehicle signage	− Pilot on motorway A16 / A58 / A2 / A67; − Pilot with ITS G5 Communication and cellular communication; − RWW and IVS, using cellular communication in the total pilot area; − Fixed, as well as mobile RSUs, enabling ITS G5 communication;

Use Case	Pilot description
Probe Vehicle Data **End 2018 - 2019**	− > 20 fixed RSUs on motorway A16 Rotterdam – Belgian border; − Three types of messages via ITS G5: DENMs to indicate the position of the roadworks (RWW), IVI to indicate the information on the variable message signs on the gantries (IVS - variable speeds or red crosses) and CAMs (data sent by the vehicles); − Secured messages; − A number of vehicles equipped with OBUs, in order to be able to evaluate the services; − Regular traffic conditions; − Situations with real roadworks; − Analysis of all logged data to determine the performance; − Experience from the previous pilots and TESTFESTs will be taken into account to set up the pilot.
GLOSA	− Pilot on main road through Helmond; − Pilot with ITS G5 Communication and cellular communication; − > 20 fixed RSUs on main road through Helmond; − A number of vehicles equipped with OBUs, in order to be able to evaluate the services; − Regular traffic conditions; − Analysis of all logged data to determine the performance; − Experience from the previous pilots and TESTFESTs will be taken into account to set up the pilot.
Optimal Route Advice and Balanced priority for dedicated vehicles	− Pilot with cellular communication − A number of heavy vehicles equipped with an application on a smartphone − A fleet will be recruited among carriers operating at FloraHolland. In addition, synergies with the Talking Traffic vehicle fleet will be attempted − Regular traffic conditions, including situations with real traffic jams − Intelligent traffic lights (GLOSA) at the N201 between FloraHolland and the motorway A2 − A platform where real time traffic information and iTLC information is available − VMS's at FloraHolland
ETA and Dock Reservation	− Identifying logistics hubs along the InterCor network in the Netherlands and choose potential logistic companies for logistics services; − The service provider gives information about real-time traffic information and expected time of arrival to participating logistics hubs. − Terminal operators at logistic hubs provide available timeslots for (un)loading trucks at docks to a data access point. − Transport planners use this service to assign routes and docks to trucks. − Regular traffic conditions; − Analysis of all logged data to determine the performance.

Table 1 – Overview of pilot activities in the Netherlands

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8. The Slovenian Pilot site

Pilot overview

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.

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).

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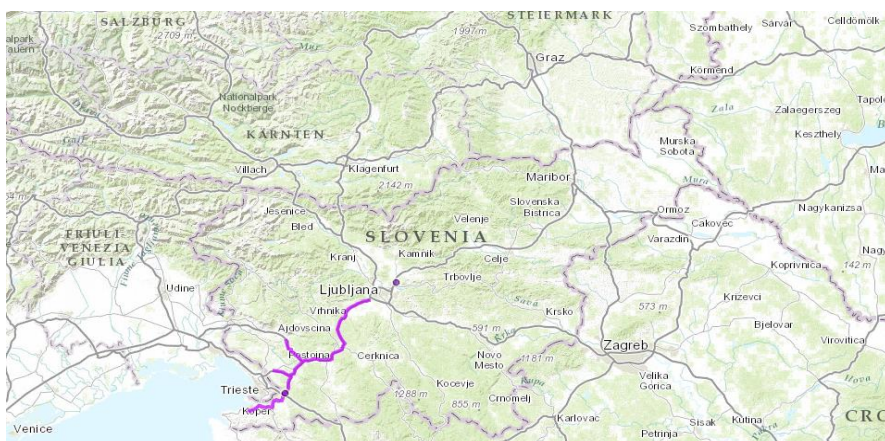
On the C-ITS Slovenia pilot site the "C-Roads Slovenia 2" roadside C-ITS-G5 infrastructure will be extended to pilot length of 300 km on selected locations on complete motorway A1, A3 and H4 and at critical points of A2 with the Central C-ITS-G5 Server real-time platform located at Traffic Management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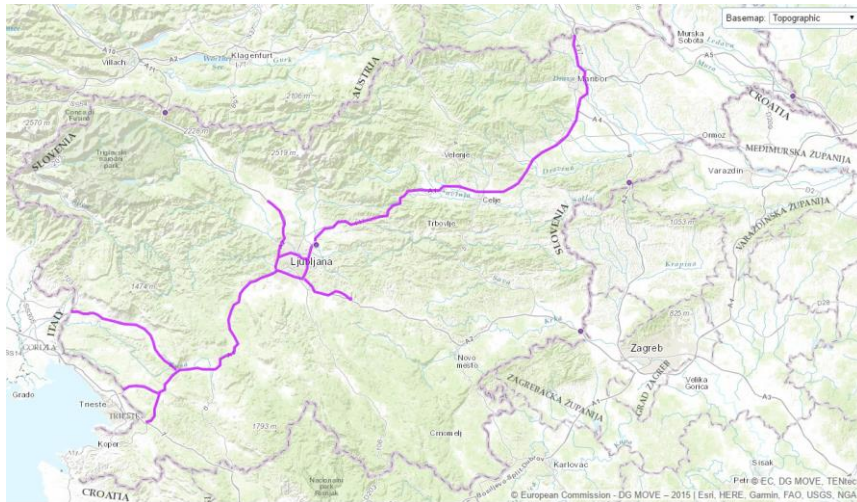
Involved partners

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

Services and technologies covered by the Slovenian pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Slovenian Pilot site	x	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Slovenian Pilot site			x	x	x	x	x	x	x			x		

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Schedule

2017   pilot planning and start of deployment activities
2018   first phase C-ITS-G5 Roadside Infrastructure Network operational
        C-ITS Cellular Connected Car Pilot deployment
2019   first phase C-ITS-G5 Roadside Infrastructure Network testing
        C-ITS Cellular Connected Car Pilot deployment testing
2020   extended pilot C-ITS-G5 Roadside Infrastructure fully operational
        C-ITS-G5 Central Platform deployed and fully operational
        C-ITS-G5 Roadside Infrastructure and Central Platform assessment and evaluation

Demonstration plan

Declared output of C-Roads Slovenia Pilot is the delivery of Central C-ITS-G5 Server and at least 60 deployed C-ITS-G5 roadside units with the operational delivery of C-ITS Day-1 service related to motorways and tested for interoperability with the assessment report.

C-ITS-G5 roadside services will be tested with limited small number of dedicated cars (2-5) and interested car producer representatives will be invited for common testing of their C-ITS systems what we will include in the test reports. Partners from C-Roads Platform will also be invited to test the interoperability.

Mobile traffic information application DARSTraffic+ with the location and driving direction awareness and C-ITS services will be tested internally for technical issues. User acceptance will be performed at the end with the extensive questionnaire survey with more than 100 users.

C-ITS-G5 Roadside Infrastructure, C-ITS Cellular Cloud Connected Car and Central Platform will be assessed and evaluated according to C-Roads Platform methodology and plan for common reports and outputs. Extensive national evaluation papers will be delivered in 2020. Dissemination activities plan is web portal with ongoing information and 2020 C-Roads Slovenia Road Show, one for general public and one for ITS stakeholders. Results will also be presented at various national or international meetings, workshops and conferences.

9. The UK Pilot site

Pilot overview

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).

Location

Involved partners

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

Services and technologies covered by the UK pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
UK Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
UK Pilot site						X		X		X		X		

Schedule

The schedule starts with the preparation for the development and deployment of C-ITS services on the A2/M2 in Kent which is an ongoing and dynamic task for the whole project duration. By the end of summer 2018 the first services will be implemented as part of an InterCor Testfest into Hybrid Communications. Subsequently, all the services will be deployed and implemented by the November 2018 as part of the InterCor pilot operation.

Demonstration plan

By November 2018, the four services (GLOSA, IVS, RWW and PVD) should be operational and ready for demonstration. The demonstration will be held until 31 May 2019 followed by an evaluation exercise. The following deployments will be demonstrated:

- o Trial Phase 1 - Delivery of up to 4km of continuous ITS G5 wireless access infrastructure. Prototype system and services to test and evaluate the infrastructure before wider deployment of Phases 1a. LTE deployment in Phase 1 trial area.

o Trial Phase 1a – Highways England centralised system to deliver early Day 1 services: using NTOC, simple 3rd party service; CHARM I/F development; Transport for London (TfL) and Kent County Council (KCC) services interface. Delivery of up to 16.5 km of continuous ITS G5 wireless access infrastructure LTE deployment in Phase 1 & Phase 1a trial area.

The phases described above apply mainly to the Highways England deployment of services. Service deployment differs between UK partners and is set out in the following table:

Distribution of Day-1-services between UK partners

	Road works warning	In-vehicle signage	Probe vehicle data	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)
UK Pilot site	X	X	X	X
Highways England	X	X	X	
Transport for London	X	X	X	X
Kent County Council				X

Highways England and Kent County Council intend to deliver their services through both ITS-G5 and Cellular as a 'Hybrid' communications solution, whilst Transport for London intends to deliver the services via Cellular only.

To demonstrate the services, test vehicles are needed. The intention is to equip 120 Kent County Council fleet vehicles with the possibility of adding further vehicles through a procurement exercise ready for demonstration.

10.   The Belgium (Wallonia) Pilot site

Pilot overview

The main objectives of the C-Roads Wallonia pilot is to operate and assess the deployment of a cloud based solution for co-operative ITS services, to connect road users with Traffic management centres (TMC) and allowing TMC to directly interact with the end users. The pilot will bring the opportunity to expand or upgrade Traffic Information Services and Traffic Management Services offered today, building on a digital 'virtual infrastructure', feed and support a discussion on the future role of the public road operator.

Location

The following roads are covered:

- A3 (E40) : Highway Brussels Aachen part in Wallonia to German border
- A4 (E411) : Highway Brussels Luxemburg, part in Wallonia to Luxemburgish border
- A26 (E25) : Liège to A4 / A26 interchange
- A602 (E25/E40) : Liège A3 / A26 interchange
- A15 (E42) : Namur to Liège

Involved partners

- SOFICO - technically assited by Public Service of Wallonia / Directorate of Road Traffic Management - already has implemented many traffic information and traffic management services on its network.
- Tractebel Engineering SA
- ITS Belgium

Services and technologies covered by the Belgium (Wallonia) pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
BE (Wallonia) Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
BE (Wallonia) Pilot			X	X	X	X	X		X		X			

Schedule

Walloon Pilot Site disseminations plan	Q2/2018	Report available and approved by Walloon site project management team (PMT)
Demonstration of the Walloon Pilot Site	Q4/2019	Roadshow available for public
Detailed technical specifications of the Walloon Pilot Site	Q2/2018	Report available and approved by Walloon site project management team (PMT)
Detailed evaluation plan of the Walloon Pilot Site	Q2/2018	Report available and approved by Walloon site project management team (PMT)
Start of the Walloon Pilot	Q1/2019	Verified by Walloon site project management team (PMT)
Evaluation report	Q3/2020	Report available and approved by the Walloon site project management team (PMT) and board

Demonstration plan

Planned Deliverables:

- Selected C-ITS use cases to be supported

- an Android OS based application to road users

- a dedicated User interface for the Traffic Management Centre

- a Web based interface for educating and instructing drivers

- Test site in operation

- Summary report on the operations performed and lessons learned

11. The Danish Pilot site

Pilot overview

The Danish pilot site is part of the NordicWay 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.

NordicWay pilots will:

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

- 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.

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

- 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.

Location

The Danish pilot focuses on connecting the existing TMC and its backbone systems to the common NordicWay architecture, which mean that all larger roads in Denmark are included.

Involved partners

The Danish Road Directorate.

Services and technologies covered by the Danish pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Danish Pilot site	**TBD**	x			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Danish Pilot site			x	x	x	x	x			x				

Schedule

2018-2020

Demonstration plan

TBD

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12.   The Finnish Pilot site

Pilot overview

The Finnish pilot site is part of the NordicWay 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.

NordicWay pilots will:

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

- 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.

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

- 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 Finnish pilots include (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 piloted C-ITS services are:

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
- Traffic signal priority request by designated vehicles
- Green light optimal speed advisory
- Probe vehicle data

Day 1.5 C-ITS:

- Traffic information and smart routing

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

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 will take place on the core corridor. The exact coverage of the pilot will be determined based on the socio-economic assessment carried out in the EU CEF Action NordicWay 2014-EU-TA-0060-S as well in open market discussion when planning the C-ITS deployment in Finland. The corridor location in minimum is the E18 corridor (Scan-Med corridor) between Helsinki and Turku, including the urban links and especially the incident prone ring roads and arterials in the Helsinki regions.

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:
  - Lapland University of Applied Sciences (Lapland UAS) as a leader, in addition to Lapland UAS is Roadscanners ltd
  - Sensible 4 Ltd as a leader, in addition to Sensible 4 are Metropolia University of Applied Science Ltd, Sharpeye Systems Ltd, MHR Consulting, F-Secure Ltd, Solidpotato Ltd ja Nodeon Ltd
  - VTT Technical Research Centre of Finland Ltd as a leader, in addition to VTT are Dynniq Finland Ltd, Indagon Ltd, Infotripla Ltd and Ukkoverkot Ltd.

The relevant C-ITS Day 1 and Day 1.5 service providers and partners will be selected through an open tendering. The tendering will start in winter-spring 2018 and completed until end of September 2018. First open market discussion is held in 1st of December 2017 at Helsinki, Finland.

Services and technologies covered by the Finnish pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Finnish Pilot site	(x)	x			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Finnish Pilot site		x	x		x	x	x	x	x	x		x	x	x

Schedule

The Artic Challenge for automated driving in snowy and icy arctic conditions between 2017 and 2019. Three open for all test fests are held between 15.-19. January 2018, 1.-5. October 2018 and 4.-8. March 2019. Final results will be reported at the end of 2019.

The relevant C-ITS Day 1 and Day 1.5 service between 2018 and 2020. The tendering will start in winter-spring 2018 and completed until end of September 2018. Deployment is planned between June 2019 and June 2020. Results published at the end of 2020.

Demonstration plan

The Artic Challenge for automated driving in snowy and icy arctic conditions will demonstrate interoperable hybrid communication Day 1 C-ITS services cross-border and automated driving part of the ITS Summit 2018 January at Olos, Finland.

The relevant C-ITS Day 1 and Day 1.5 service will demonstrate interoperable hybrid communication services cross-border in NordicWay and Europe.

13.   The Hungarian Pilot site

Pilot overview

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 ('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.
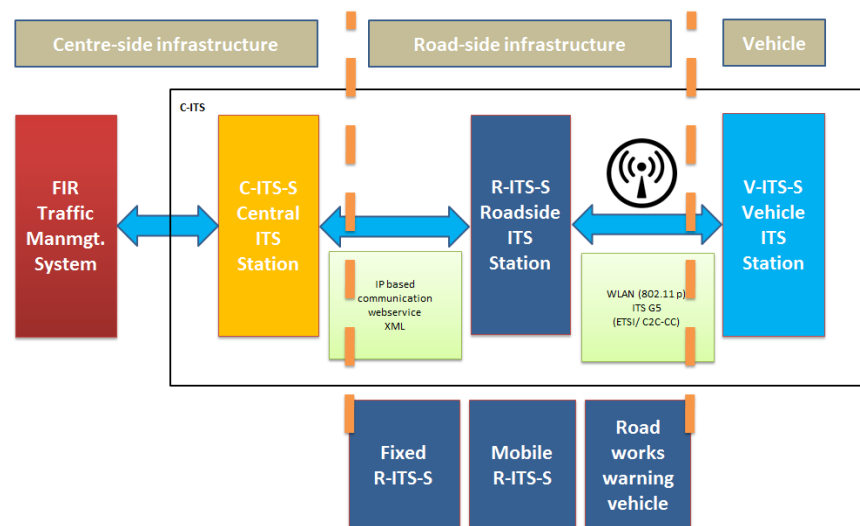
In the framework of C-Roads Hungary pilot extension the Implementing Body intends to extend the C-ITS deployment both in terms of geographical coverage, and offered services. The focus shall be put on urban deployment, in particular GLOSA/Time-to-green as well as intersection safety (signal violation). The upgrade should also concern the communication technology – deployment of hybrid DSRC / cellular technology is envisaged in near future.

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.
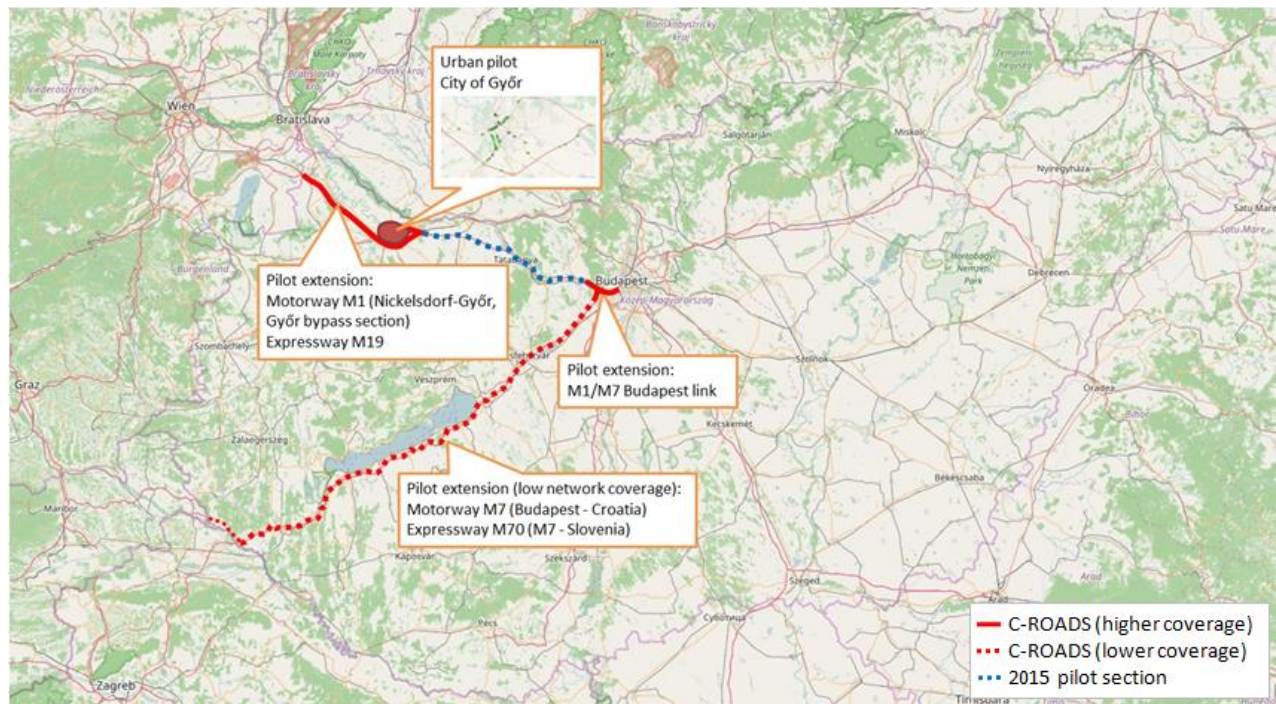
Involved partners

Beneficiary: Ministry of National Development (MND)
Implementing body: Hungarian Public Road Non-profit PLC.

Partners planned to be involved:
- Budapest University of Technology and Economics (BUTE)
- Budapest Public Road PLC.
- Automotive Proving Ground Zala LTD. (APZ)
- City of Győr
- ITS Hungary Association (dissemination)

Services and technologies covered by the Hungarian pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Hungarian Pilot site	X	X			

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Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Hungarian Pilot				X	X	X	X	X	X	X		X	X	

Schedule

- As the first step, we plan to evaluate the 2015 pilot section (Q2 2018).
- Tests will be running from the second half of 2018 till the end of 2020.
- By the end of 2019 new OBUs and RSUs shall be in operation.
- The infrastructure of the new urban pilot should be deployed until end of 2019 and shall be operational by mid 2020.
- Roadshows and cross-tests are planned for 2020.

Demonstration plan

C-ITS services will be tested with limited number of dedicated cars and interested car producer representatives will be invited for common testing of their C-ITS systems what we will include in the test reports. At least 20 vehicles will be involved in the testing. At least 10 devices will be used for internal testing and we provide at least 10 devices to our partners for external testing (eg. University). Partners from C-Roads Platform will also be invited to test the interoperability.

The test will be running from the second half of 2018 till the end of 2020. During that time we are collecting the data continuously from the test devices. A minimum of two different types of equipment will be used for testing in the public procurement process to ensure the interoperability.

Expected indicators for pilot extension in Hungary:

- at least 70 new roadside units
- at least 10 intersections installed with C-ITS functions

Declared output of C-Roads Hungary Pilot is the delivery of extended and tested C-ITS Day-1 service related to motorways and urban areas as well. Besides ITS-G5, cellular communication shall also be implemented and tested for interoperability with the assessment report.

Results will also be presented at various national or international meetings, workshops and conferences. Dissemination activities will be carried out via web portal, social media and C-Roads Hungary Road Show, one for general public and one for ITS stakeholders, together with our dissemination partner ITS Hungary Association.

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14.   The Italian Pilot site

Pilot overview

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.

Location
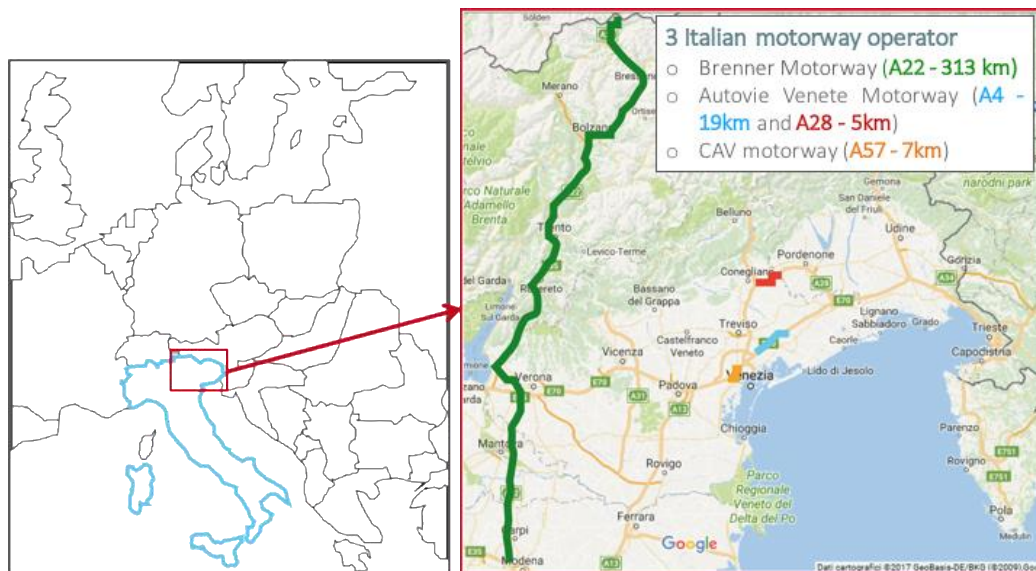
Involved partners

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.;
- F.lli Codognotto di Codognotto Gianfranco & C. – S.N.C.;
- 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.

Services and technologies covered by the Italian pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Italian Pilot site	X	X			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Italian Pilot site	X		X	X		X	X	X	X	X				

Schedule

The C-ROADS ITALY Pilot start by 08/02/2017 and will end by 31/12/202

by 28/02/2018	Platooning vehicles obtained
by 30/03/2018	Call for tender to equip 20 km of Brenner motorway with V2X technology
by 31/05/2018	V2X Plug test
by 30/06/2018	Data interface between C-Roads and Highway Chaffeur vehicle specified
by 30/09/2018	Test infrastructure operational - Chauffeur
by 30/09/2018	Platooning Use Cases Investigation, Technology requirement and Selection Report
by 30/09/2018	Chauffeur Use Cases Investigation, Technology requirement and Selection Report
by 30/09/2018	Lab tests on Highway Chaffeur vehicle components started
by 31/12/2018	First test vehicles equipped and operational - Chauffeur
by 30/06/2019	First test vehicles equipped and operational - Platooning

Demonstration plan

By the end of 2017 the Brenner Motorway will have completed the mapping and design of the RSUs to install along the Brenner Motorway and will have started the purchase process of all RSUs. It will also have started drafting the documentation for the tender needed to award the works aiming at preparing the infrastructure (electrification, cabling, etc.) for the extension of the existing V2X test site.

It will begin interfacing the RSUs with the C-ITS server at the TCC and creating the web interface of the C-ITS server for infrastructure management, status map for RSU and Events and UCs simulation (independently from the TCC).

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by 30/09/2018	30 km of continuous Brenner motorway stretch equipped with V2X technology
by 30/04/2019	20 km of Brenner motorway equipped with V2X technology, from the Austrian border (km 0) to km 20 (rest area Trens East/West), ready for start testing phase
by 30/04/2019	10 km of Autovie Venete motorway equipped with V2X technology, ready for start testing phase
by 31/10/2019	10 km of CAV motorway equipped with V2X technology, ready for start testing phase
by 30/04/2020	Test infrastructure operational - Platooning
by 30/06/2020	Start cross border Chauffeur test with Austria
by 30/06/2020	Start cross border Platooning test with Austria

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15.   The Norwegian Pilot site

Pilot overview

The Norwegian pilot site is part of the NordicWay 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.

NordicWay pilots will:

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

- 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.

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

- 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

- o 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.

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.

Involved partners

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

Services and technologies covered by the Norwegian pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Norwegian Pilot site	(x)	x			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Norwegian Pilot	x		x		x	x	x	x	x	x		x	x	

Schedule

2018-2020

Demonstration plan

Demonstration plan finalized by the end of 2017 early 2018

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16.   The Portuguese Pilot site

Pilot overview

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 Acess Point – SPA and SPApp usage app for SPA Services

This activity consists on the design of the National Single Point of Acess (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;

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- 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 Lisbon 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.

<u>Sub-activity 5.2</u>: 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.

Location

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

Pilots 1 to 5
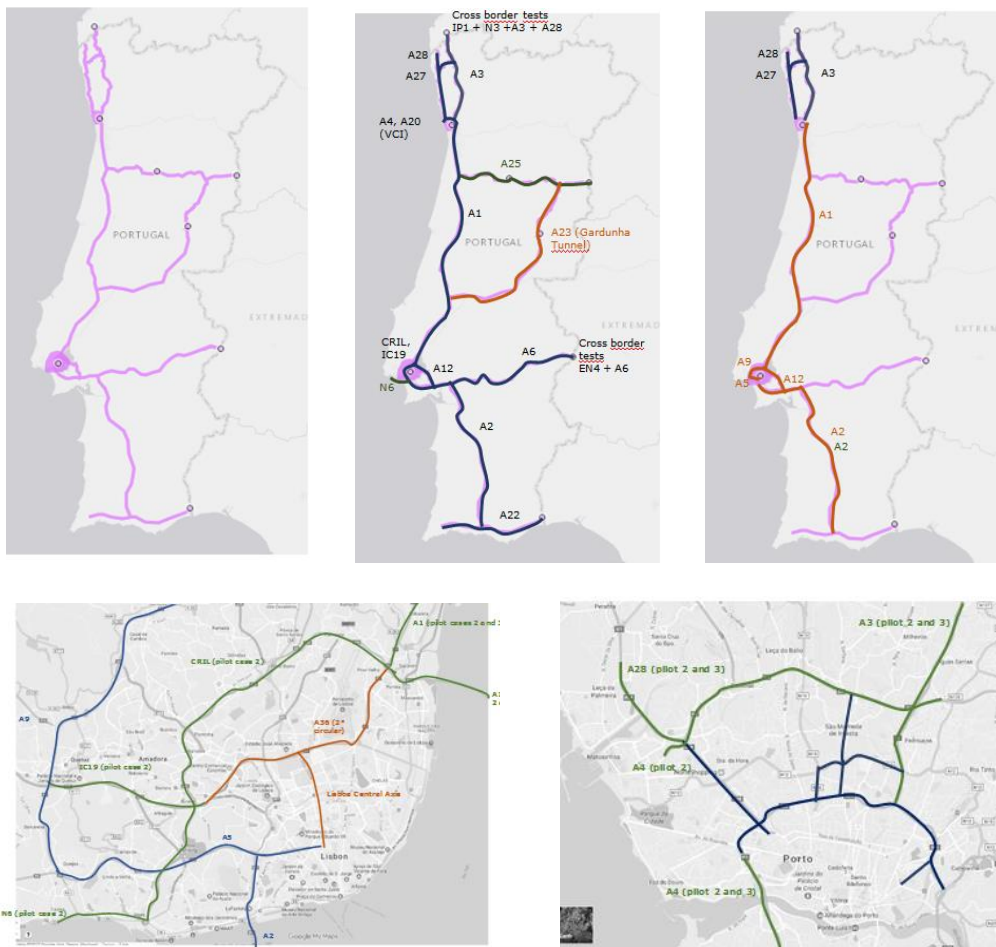
Involved partners

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.;

Services and technologies covered by the Portuguese pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth	Other (DATEX II)
Portuguese Pilot site	x	x			x	x

	"SPA" and SPApp usage app for SPA Services		Portuguese network for C-ITS			Network Preparation for Connected and Autonomous Vehicles			C-ITS Pilot in the Lisboa Urban Node					C-ITS Pilot in the Porto Urban Node	
	Backbone data sharing prototype	SPApp usage app	Demonstration of C-ITS services in core, comprehensive network and access to urban roads	In-vehicle app to connect C-ITS server in TEN-T network and urban nodes connections	Development of C-ITS services in tunnels	Connected and autonomous vehicles in open roads	A2 the Holiday motorway	Connected vehicles	Traffic service level monitoring and travel time prediction in Lisboa node	Parking availability system in Lisboa node	In-vehicle app to connect C-ITS server in Lisboa node	Signal corridors and bus corridors prioritization in Lisboa node	Mobility Hub in Lisboa node	Traffic service level monitoring in real time and 2-hour travel time prediction in the Porto node	V2I and I2V integration of the CaetanoBUS vehicle with the infrastructure in Porto node for information and services sharing
Communication technologies used															
ETSI G5			x	x	x	x	x	x			x		x		
Cellular Communication		x	x	x	x	x	x	x	x		x	x	x	x	x
DAB															
RDS															
WiFi and Bluetooth			x	x				x		x	x		x	x	x
Other	DATEXII	DATEXII								x			DATEXII	DATEXII	

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Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Portuguese Pilot site	x	x	x	x	x	x	x	x	x	x	x	x	x	X

	"SPA" and SPApp usage app for SPA Services		Portuguese network for C-ITS (incl. accesses to urban nodes)			Network Preparation for Connected and Autonomous Vehicles			C-ITS Pilot in the Lisboa Urban Node					C-ITS Pilot in the Porto Urban Node	
	Backbone data sharing prototype	SPApp usage app	Demonstration of C-ITS services in core, comprehensive network and access to urban roads	In-vehicle app to connect C-ITS server in TEN-T network and urban nodes connections	Development of C-ITS services in tunnels	Connected and autonomous vehicles in open roads	A2 the Holiday motorway	Connected vehicles	Traffic service level monitoring and travel time prediction in Lisboa node	Parking availability system in Lisboa node	In-vehicle app to connect C-ITS server in Lisboa node	Signal corridors and bus corridors prioritization in Lisboa node	Mobility Hub in Lisboa node	Traffic service level monitoring in real time and 2-hour travel time prediction in the Porto node	V2I and I2V integration of the CaetanoBUS vehicle with the infrastructure in Porto node for information and services sharing
Day-1-services covered															
Emergency electronic brake light			x			x							x		
Emergency vehicle approaching			x		x		x	x			x	x	x		
Slow or stationary vehicle(s)	x	x	x	x	x	x	x	x	x				x		
Traffic jam ahead warning	x	x	x	x	x	x	x	x	x				x	x	x
Other hazardous location notification	x	x	x	x	x	x	x	x					x		
Road works warning	x	x	x	x	x	x	x	x			x		x	x	x
Weather conditions	x	x	x	x	x	x	x	x					x	x	x
In-vehicle signage		x	x		x	x	x	x					x		x
In-vehicle speed limits		x	x		x	x	x	x					x		x
Probe vehicle data			x				x	x					x		x
Shockwave damping			x										x	x	x
Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)													x		x
Signal violation/Intersection safety		x				x									
Traffic signal priority request by designated vehicles													x	x	x

Day-1.5 services covered

	Off-street parking information	On-street parking management and information	Park & Ride information	Information on alternative fuel vehicles & charging stations	Traffic information & smart routing	Zone access control for urban areas	Loading zone management	Vulnerable road user protection	Cooperative Collision Risk Warning	Motorcycle approaching indication	Wrong way driving	Connected and cooperative navigation
Portuguese Pilot site	x	x	x	x	x	x					x	x

	"SPA" and SPApp usage app for SPA Services		Portuguese network for C-ITS (incl. accesses to urban nodes)			Network Preparation for Connected and Autonomous Vehicles			C-ITS Pilot in the Lisboa Urban Node					C-ITS Pilot in the Porto Urban Node	
	Backbone data sharing prototype	SPApp usage app	Demonstration of C-ITS services in core, comprehensive network and access to urban roads	In-vehicle app to connect C-ITS server in TEN-T network and urban nodes connections	Development of C-ITS services in tunnels	Connected and autonomous vehicles in open roads	A2 the Holiday motorway	Connected vehicles	Traffic service level monitoring and travel time prediction in Lisboa node	Parking availability system in Lisboa node	In-vehicle app to connect C-ITS server in Lisboa node	Signal corridors and bus corridors prioritization in Lisboa node	Mobility Hub in Lisboa node	Traffic service level monitoring in real time and 2-hour travel time prediction in the Porto node	V2I and I2V integration of the CaetanoBUS vehicle with the infrastructure in Porto node for information and services sharing
Day-1.5-services covered															
Off-street parking information		x	x	x		x				x	x				
On-street parking management and information										x				x	
Park & Ride information		x	x			x	x	x		x			x		
Information on alternative fuel vehicles & charging stations			x			x	x			x			x		
Traffic information & smart routing		x	x	x		x	x	x	x	x	x	x	x	x	x
Zone access control for urban areas			x			x	x						x		
Loading zone management															
Vulnerable road user protection															
Cooperative Collision Risk Warning															
Motorcycle approaching indication															
Wrong way driving			x		x	x	x						x		
Connected and cooperative navigation		x				x	x	x						x	x

Schedule

2017-2020

Demonstration plan

This study will provide the framework to assess the C-ITS Services, its overall impacts and benefits, while addressing its long term viability, cost-efficiency, governance and business models.
With C-Roads Portugal successfully completed, C-ITS services will be implemented along 964 km ensuring a continuity of service in urban nodes and core network. In total 212 RSU will be installed with 180 OBU and 162 vehicles in operation.

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17.   The Swedish Pilot site

Pilot overview

The Swedish pilot site is part of the NordicWay 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.

NordicWay pilots will:

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

- 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.

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

- 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. This will be shown by testing Day-1 and Day-1,5 services.

C-ITS Day-1 services:

- Emergency vehicle approaching (EVA)
- Connected Traffic Signals including:
    - Traffic signal priority request by designated vehicles (TSP)
    - Green Light Optimal Speed Advisory (GLOSA)
- Hazardous Location notification (HLW): Roads works warning, emergency brake light, Emergency vehicle approaching and other hazards.

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C-ITS Day-1,5 services:

- Traffic information and smart routing (TISR)
- Connected & Cooperative navigation into and out of the city (CCN)

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.

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
- Myndigheten för samhällsskydd och beredskap
- Uppsala kommun
- Södertälje kommun
- Zenuity AB
- IBM Svenska AB
- Swarco Sverige AB
- Technolution AB
- Springworks AB
- Carmenta AB
- DB Schenker
- Veridict AB
- Statens Väg och Transportforskningsinstitut
- Mindconnect AB
- Chalmers University of Technology
- KTH - Integrated Transport Research Lab (ITRL)
- Combitech AB
- Triona AB
- RISE Interactive Institute AB

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Services and technologies covered by the Swedish pilot

Communication technologies used

	ETSI G5	Cellular Communication	DAB	RDS	WiFi and Bluetooth
Swedish Pilot site	(x)	x			

Day-1-services covered

	Emergency electronic brake light	Emergency vehicle approaching	Slow or stationary vehicle(s)	Traffic jam ahead warning	Hazardous location notification	Road works warning	Weather conditions	In-vehicle signage	In-vehicle speed limits	Probe vehicle data	Shockwave damping	Green Light Optimal Speed Advisory (GLOSA) / Time To Green (TTG)	Signal violation/Intersection safety	Traffic signal priority request by designated vehicles
Swedish Pilot site	x	x			x	x		x				x		x

Schedule

2018-2020

Demonstration plan

The Swedish pilot will demonstrate the implemented C-ITS services in real traffic 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. The aim is to implement services that will operate seamless between all the NordicWay pilot sites. The Pilot plan which will specify this in detail is due in September 2018 and the pilots are planned to start in May 2019.

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18.   The Spanish Pilot site

Pilot overview

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.

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.
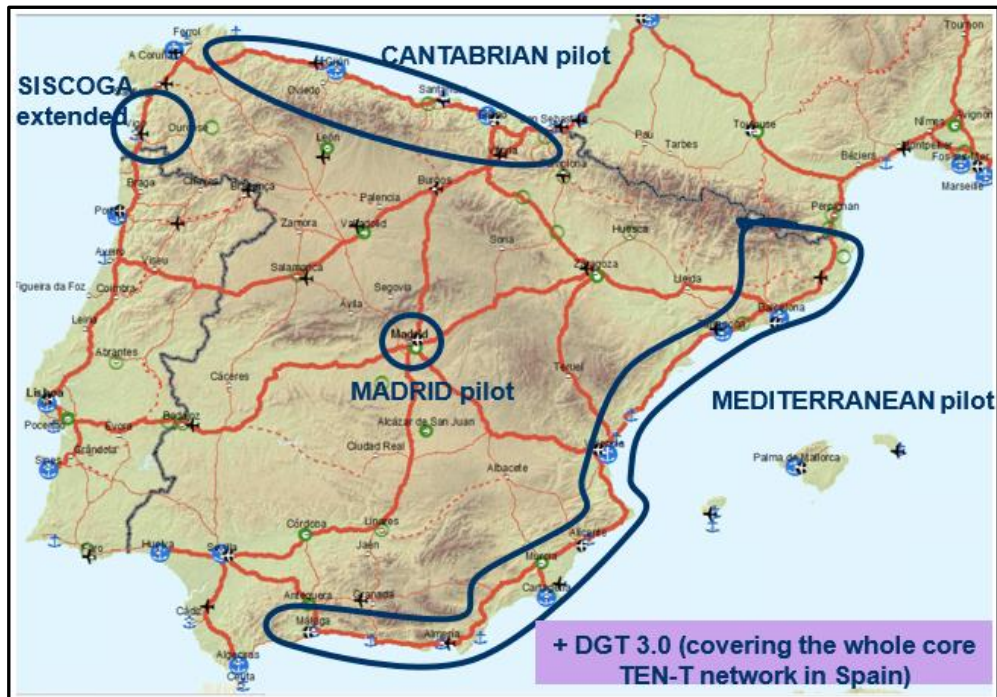
Figure 5. Location of the Spanish pilot site

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).

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o Universitat Politècnica de Catalunya (UPC).
o Universitat de Valencia – Estudi General (UVEG).
- Research Centres:
  o Fundación para la Promoción de la Innovación, Investigación y Desarrollo Tecnológico en la Industria de Automoción de Galicia (CTAG).
  o Asociación Centro Tecnológico Ceit-IK4.
- Regional authorities:
  o Council of Vigo city.
  o Diputación Foral de Bizkaia - Bizkaiko Foru Aldundia.

Services and technologies covered by the Spanish pilot

A separate description is provided for each of the subpilots that build up the Spanish pilot.

		DGT 3.0	SISCOGA Extended	MADRID	CANTABRIAN. País Vasco	CANTABRIAN. Asturias	CANTABRIAN. A8 Galicia	MEDITERRANEAN. CATALAN	MEDITERRANEAN. ANDALUSIAN
DAY 1 SERVICES / Hazardous Location Notification	Slow or stationary vehicle(s)	X	X	X	X	X		X	X
	Road works warning	X	X	X	X			X	X
	Weather conditions	X	X	X	X		X	X	
	Emergency break light		X						
	Emergency vehicle approaching	X	X	X					
	Other hazardous location notifications	X	X					X	
DAY 1 SERVICES / Signage Application	In-vehicle signage		X					X	
	In-vehicle speed limits	X	X	X				X	
	Signal violation / intersection safety		X						
	Traffic signal priority request by designated vehicles		X						
	Green Light Optimal Speed Advisory (GLOSA)		X						
	Probe Vehicle Data	X	X		X			X	
	Shockwave Damping (ETSI - local hazard warning)	X	X					X	X
	Information on fuelling & charging stations for alternativ	X	X					X	
DAY 1 , 5 SERVICES	Vulnerable Road user protection	X							
	On street parking management & information	X	X	P					
	Off street parking information	X	X	P					
	Park & Ride information	X	X	P		X			
	Connected & cooperative navigation into and out of the		X						
	Traffic information & Smart routing	X	X	X		X			X
Communication technologies	**ETSI G5**		X	X	X	X	X	X	X
	Cellular Communication	X	X	X	X	X	X	X	X
	Wifi and Bluetooth				X				

Schedule

The C-Roads Spain consortium has defined an initial time scheduling for deployment structured as follows:

- **Q2/2018: Spanish pilot set-up ready**. Vehicles, road infrastructure, and communications infrastructure are available for the start of the piloting phase.
- **Q1/2019: Finalisation of the first phase of the Spanish pilot**. Initials tests are finished, and followed by a preliminary outcome evaluation phase.

- **Q2/2019: Preliminary evaluation report of Spanish pilot (Phase 1)**. The evaluation results corresponding to the first phase of the pilot are available.
- **Q4/2019: Finalisation of the second phase of the Spanish pilot**. After the evaluation phase, and taking into account its conclusions and recommendations, a second round of tests is performed.
- **Q2/2020: Spanish pilot final evaluation report**. The evaluation results of the Spanish pilot are available.

Demonstration plan

DGT 3.0

The Pilot will be located along the overall road network in Spain with an extension of approximately 12,270 km.

The following Day 1 and Day 1.5 services will be deployed under this pilot:

- Day 1 services:
    - Slow or stationary vehicle(s) & Traffic ahead warning.
    - Road works warning.
    - Weather conditions.
    - Emergency vehicle approaching.
    - Other hazardous notifications.
    - In-vehicle speed limits.
    - Probe vehicle data and Shockwave Damping.

- Day 1.5 services:
    - Information on fuelling & charging stations for alternative fuel vehicles.
    - Vulnerable road user protection.
    - On street parking management & information.
    - Off street parking information.
    - Park & Ride information.
    - Traffic information & smart routing.

These services will be deployed through an IoT (Internet of Things) Platform using cellular based communication technologies (3G and 4G/LTE) and the estimated number of users is 10,000.

SISCOGA Extended

This pilot comprehends 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. The current existing infrastructure covers 120 km of interurban and urban roads. Within C-Roads Spain this test site will be extended and upgraded where necessary to establish a final total of approximately 150 km of test site infrastructure allowing the pilot operations described below.

The final pilot operations covered by the pilot will be deployed along approximately 150 km of the following road sections, identified by their kilometric points (kp):

- A55 - from kp 0 to kp 31.
- A52 - from kp 268 to kp 306.
- AP9 - from kp 149 to kp 176 and other roads in the Vigo urban area.

The following Day 1 and Day 1.5 services will be deployed under this pilot:

- Day 1 services:
  - Slow or stationary vehicle(s) & Traffic ahead warning.
  - Road works warning.
  - Weather conditions.
  - Emergency brake light.
  - Emergency vehicle approaching.
  - Other hazardous notifications.
  - In-vehicle signage.
  - In-vehicle speed limits.
  - Signal violation / Intersection Safety.
  - Traffic signal priority request by designated vehicles.
  - Green Light Optimal Speed Advisory (GLOSA).
  - Probe vehicle data and Shockwave Damping.

- Day 1.5 services:
  - Information on fuelling & charging stations for alternative fuel vehicles.
  - On street parking management & information.
  - Off street parking information.
  - Park & Ride information.
  - Connected & Cooperative navigation into and out of the city.
  - Traffic information & smart routing.

These services will be deployed using hybrid communication technologies (use of both cellular based communications and ITS-G5) and the estimated number of fleet vehicles on-board equipped is 84. In particular, ITS-G5 will be used along approximately the whole 150 km of the SISCOGA Extended pilot site.

Furthermore, the estimated fleet vehicles include 4 Autonomous Vehicles in order to analyse the integration of C-ITS services with automation.

This pilot also covers specific cross-border tests with C-Roads Portugal, including tests with C-Roads Spain vehicles in the following road sections: A55 in Spain near the border and A27 (section Viana do Castelo – Ponte de Lima) as well as A28 (section Viana de Castelo – Caminha) in Portugal.

Madrid Calle 30

The pilot will be located along the road "Calle 30" in Madrid, with approximately 32 km.

The following Day 1 and Day 1.5 services will be deployed under this pilot:

- Day 1 services:
  - Slow or stationary vehicle(s) & Traffic ahead warning.
  - Road works warning.
  - Weather conditions.

- o Emergency brake light.
- o Emergency vehicle approaching.
- o In-vehicle speed limits.

- Day 1.5 services:
    - o Traffic information & smart routing.

Other Day 1.5 services will be possible tested.

These services will be deployed using hybrid communication technologies and the estimated number of fleet vehicles on-board equipped is 120. In particular, ITS-G5 will be used approximately along the whole 32 km of the Madrid pilot site.

Furthermore, 1 Autonomous Vehicle is foreseen to be included in the fleet in order to analyse the integration of C-ITS services with automation functions.

Cantabrian pilot

The pilot will be deployed along approximately 75 km of the following road sections located in Galicia, Asturias and Basque Country:

- A8 in Mondoñedo/Galicia - from kp 536 to kp 552.
- A8 in Asturias – from kp 374 to kp 394.
- A8/AP8 in Basque Country - from kp 100 to kp 139.

The following Day 1 and Day 1.5 services will be deployed under this pilot:

- Day 1 services:
    - o Slow or stationary vehicle(s) & Traffic ahead warning.
    - o Road works warning.
    - o Weather conditions.
    - o Emergency brake light.
    - o Probe vehicle data and Shockwave Damping.

- Day 1.5 services:
    - o Park & Ride information.
    - o Traffic information & smart routing.

Additionally, the service "Cooperative collision risk warning" is also foreseen to be deployed under this pilot, consisting in the provision of information about risk of collision due to the presence of road inspection vehicles.

These services will be deployed using hybrid communication technologies and the estimated number of fleet vehicles on-board equipped is 145. In particular, ITS-G5 will be used approximately along 36 km of the following road sections: A8 in Mondoñedo/Galicia form kp 536 to kp 552 and A8 in Asturias – from kp 374 to kp 394.

Mediterranean pilot

The pilot will be deployed along approximately 125 km of the following road sections located in Catalonia and Andalusia:

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- AP7 in Catalonia - from kp 48 to kp 71.
- AP7/N340 in Andalusia - from kp 130 to kp 235.

The following Day 1 and Day 1.5 services will be deployed under this pilot:

- Day 1 services:
    - Slow or stationary vehicle(s) & Traffic ahead warning.
    - Road works warning.
    - Weather conditions.
    - Other hazardous notifications.
    - In-vehicle signage.
    - In-vehicle speed limits.
    - Probe vehicle data and Shockwave Damping.

- Day 1.5 services:
    - Information on fuelling & charging stations for alternative fuel vehicles.

Additionally, the service "Smart Slip Road" is also foreseen to be deployed under this pilot addressed to support motorway entry/exit manoeuvers.

These services will be deployed using hybrid communication technologies and the estimated number of fleet vehicles on-board equipped is 45. In particular, ITS-G5 will be used along approximately the whole 125 km of the Mediterranean pilot site.

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