Rijkswaterstaat
Ministry of Infrastructure and Water Management

Future-proofing interoperable services

Cooperative ITS Corridor


Cooperative
ITS Corridor
Joint deployment

Future-proofing interoperable services

Future-proofing, what does that mean? To me it means working towards a future-ready infrastructure. In line with the three pillars of the Smart Mobility policy of the Dutch Minister of Infrastructure and Water Management, road safety, traffic flow and sustainability, the Cooperative Intelligent Transport Systems (C-ITS) Corridor project provides an important contribution to the road safety theme in particular.

The Oxford Learner's Dictionary says: 'Safety is a concept that includes all measures and practices taken to preserve the life, health, and bodily integrity of individuals'. And that is exactly what makes it personal for me! A road accident is not just a statistic, but an event that can have an enormous personal impact. We all know of someone whose life drastically changed after being involved in a traffic accident. I myself often hear about road inspectors who were involved in an accident caused by drivers ignoring or reacting inappropriately to a red cross, indicating a blocked motorway lane because of road works or incidents.

Road safety is one of the reasons that Rijkswaterstaat finds it imperative that applicable traffic rules and regulations reach all road users. Based on the need for direct communication with the road user, I think it is important that Rijkswaterstaat opts to deploy its own infrastructure-based roadside systems at least until a sufficient in-car system alternative is widely available. Given this transition period, it is important that we continue the development of short-range Infrastructure-to-Vehicle communication!

With this booklet, our second one already, we want to give you an overview of the progress of the C-ITS Corridor project in this area, our current activities and our future plans.

Please visit our website if you would like to download a copy of our first booklet, packed with information about the C-ITS Corridor project during the so-called Pre-deployment phase. Meanwhile, I wish you a safe journey!

Abraham Bot
Project Manager C-ITS Corridor

Extract from the 'Smart mobility Dutch reality' letter from the Minister of Infrastructure and Water Management to the Chairman of the House of Representatives of the States General, October 4, 2018

'Our pragmatic 'learning by doing' approach has afforded us a great deal of experience with trials and experiments, which has improved our understanding of the developments taking place and the associated opportunities and risks for traffic safety, traffic flow and sustainability.

During this government's term of office, I would like to utilize this experience to advance to large-scale use of available products and services, with an appreciable effect on our policy objectives, and the responsible introduction of a new generation of vehicles, applications and provision of services. This entails a shift of focus from testing and experimentation to application and use in actual practice, embedding smart mobility as an integral part of policy and implementation processes.'

Introduction

In recent years the Netherlands has gained a great deal of experience in the field of Smart Mobility. The time has now come to capitalize on our experiences by advancing to scalable new generation smart mobility solutions.

Smart mobility Dutch reality!

Serge van Dam, Strategic Advisor Smart Mobility, Rijkswaterstaat

'As we are nearing deployment of C-ITS services, the expertise and insights developed in the C-ITS Corridor project prove ever more valuable. This year, the Corridor project is the foundation of our work in InterCor and input into C-Roads for harmonized services across Europe. It is now imperative that the automotive industry starts to deliver, so that we can move to full deployment.'

The Cooperative ITS Corridor

The C-ITS Corridor project is a cooperation of road operators in the Netherlands, Germany and Austria. Together with industrial partners, the road operators are working towards the introduction of C-ITS services in Europe. The project became a major building block for other international initiatives and contributes to standardization, harmonization and implementation of new cross-border services for international road users. The Dutch part of the C-ITS Corridor project is also the technical core of the Dutch contribution to the InterCor project.

InterCor

InterCor (Interoperable Corridors) is a European project, co-financed by the European Union under the Connecting Europe Facility. The project aims to enable vehicles and road infrastructure to communicate data through cellular or ITS-G5 networks, or a hybrid combination of them, on road corridors within France, Belgium, the United Kingdom and the Netherlands.

Ronald Adams, EU Project Coordinator InterCor, Rijkswaterstaat

'Large-scale testing in operational traffic is a crucial step towards cross-border deployment and towards the interoperable use of C-ITS services which will make our lives better and safer. In the C-ITS Corridor and InterCor projects we make sure this is a public-private and international effort.'

Sebe Vogel, Project Leader Concorda Metropolitan Area Amsterdam, Amsterdam Practical Trail, Rijkswaterstaat

'As Concorda – Connected Corridors for Driving Automation – we work with other national and international projects like C-ITS Corridor, Intercor and C-Roads to build the next steps towards connected automated driving, based on the lessons learned and building blocks. Concorda metropolitan area Amsterdam focusses on the next steps for integrating roadside systems and in-car systems for automation using hybrid communication.'

In this project technical specifications are validated in a broad context to enable the roll-out of interoperable C-ITS services. Rijkswaterstaat is leading this international project, reporting to the European Union.

Services

Initially, the C-ITS Corridor focused on two services: Road Works Warning (RWW) and Sensor data from vehicles (Probe Vehicle Data, PVD). Additionally, the Netherlands is also developing Collision Risk Warning (CRW) and In-Vehicle Signage (IVS).

Collaboration

Cooperation is key to the C-ITS Corridor project. In addition to contributing to the InterCor project we share results with the EU-wide C-Roads platform to contribute to complete harmonization at European level. We also collaborate with the Dutch team of the European Concorda project, delivering building blocks to support further steps towards connected automated driving. And, last but not least, we provide suppliers in the field of Smart Mobility with a great opportunity to implement and validate their solutions on our roads, speeding up joint technical development!

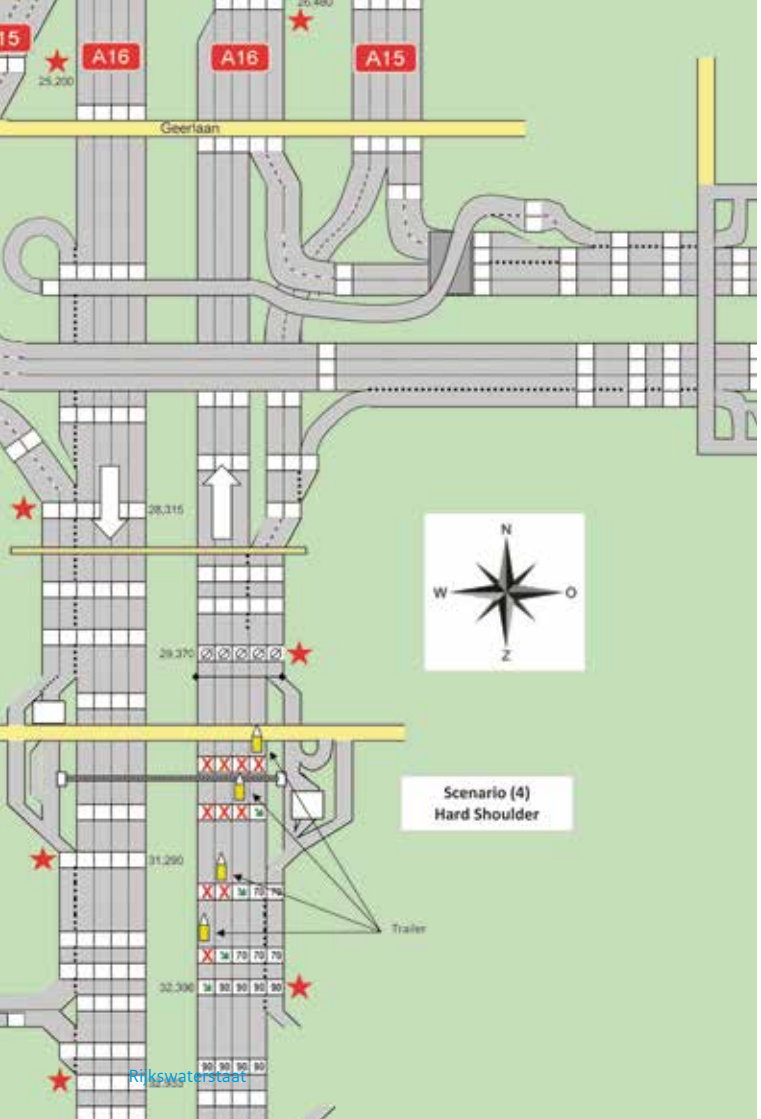
Coherence

	Cooperative ITS Corridor Joint deployment	InterCor	CONCORDA	C-ROADS (platform)
Objective	Deployment ITS-G5 Info for policy-making	Internationale hamonization and interoperability	Level 3 autonomous in combination with hybrid services	International harmonization and interoperability
Partners				
Services	RWW, PVD (IVS) On motorway network	RWW, PVD, IVS, GLOSA, Logistics On motorway network and urban/provincial network	RWW, PVD, IVS, Hazardous location notification, Intersection On motorway network and urban/provincial network	RWW, PVD, IVS, GLOSA, ... Coordination specs
Technology	Hybrid, focus on ETSI-G5	Hybrid, with ETSI-G5 as basis	Hybrid (ETSI-G5 and cellular)	Hybrid, with ETSI-G5 as basis
Building Blocks	Harmonized specs, RSU, CU, Backend, PKI security, cellular service providers, test vehicles, evaluation	Harmonized specs, RSU, CU, Backend, PKI security, cellular service providers, test vehicles, evaluation	RSU, CU, Backend, PKI security, cellular service providers, test vehicles, level 3 autonomous, evaluation	Operational conditions for interoperability in pilots in terms of specs, organization, evaluation
Vehicles	Test vehicles with ETSI-G5 OBU Enabling messages for autonomous	Test vehicles with ETSI-G5 OBU Enabling messages for autonomous	Test vehicles with ETSI-G5 OBU/Commbox Level 3 OEM autonomous	Arrangement to test with vehicles at test sites of the other countries

1 So Far

Looking back at the activities of the C-ITS Corridor project, cross-border testing is probably the most characteristic feature.

Since the first tests on the Corridor, the C-ITS test site on the A16 motorway has continuously been upgraded. With that site near Dordrecht as a basis, the Corridor team has sought cooperation with vehicle manufacturers, their suppliers and knowledge institutes, to test whether their C-ITS applications functioned properly on this test bed. On the other hand the Corridor team has participated in several interoperability tests in other EU-countries with the Rijkswaterstaat test vehicle. Not only at the site of the German colleagues of the C-ITS Corridor, but also in France and England. This cross-border testing led to important steps towards the full alignment of specifications and enabled a substantial contribution to the harmonization in the C-Roads platform.



1.1 Future-ready infrastructure

The state-of-the art C-ITS test bed is operational on the A16 motorway near Dordrecht to allow field tests in live traffic conditions.

The hybrid test bed supports both WiFi-p and 3G/4G cellular services. This location, on the very important logistical axis of Antwerp-Rotterdam, represents one of the most complex traffic situations in the Netherlands, including a motorway tunnel. The test bed offers non-stop C-ITS services like RWW and IVS. An extension of the test bed towards Amsterdam will enable automated driving field tests, thanks to the super low latency and total radio reception coverage characteristics of the site.

Vehicles equipped with On Board Units (OBUs) regularly visit the test bed to test the latest HMI in-vehicle implementations. The test bed also serves as a basis for collecting data from operational services.

1.2 Main live test events

The C-ITS Corridor successfully organized and participated in the first InterCor ITS-G5 TESTFEST in the Netherlands in July 2017. Testing took place on the C-ITS test bed on the A16 motorway near Dordrecht. RWW, PVD and IVS services were available via fixed Road Side Units (RSUs) for testing both in representative lab environments and in live traffic conditions.

In July 2017 the project participated in an open trial operation ('Probebetrieb') in Germany. Roadworks warnings were sent via ETSI-G5 to selected short-term roadworks via safety trailers. Road operator Hessen Mobil equipped trailers of the road maintenance authorities with short-range communication technology to thoroughly test and evaluate the system components, the overall system and the related processes during the operational road service.

In April 2018, the project participated in the InterCor PKI Security TESTFEST in France, validating the international interoperability of cooperative Public Key Infrastructure (PKI) solutions, including the authentication of messages exchanged between ITS stations with different origins.

In anticipation of the third InterCor TESTFEST, the project took part in the so-called GLOSA pre-TESTFEST in Helmond in June 2018. It was organized by the Province of Noord-Brabant (NL) together with its InterCor partners in the UK. Main objective was to validate the interoperability of ITS hybrid GLOSA (Green Light Optimized Speed Advisory) services, based on the common set of specifications developed in the InterCor project.

Finally, in October 2018, the UK partners in InterCor organized the third InterCor TESTFEST, the Hybrid TESTFEST. The Dutch InterCor partners (Rijkswaterstaat and the Provinces of Utrecht and Noord-Brabant) participated with a joint InterCor NL entry. At this TESTFEST four different services were tested: GLOSA, IVS, RWW (all three services using cellular and ITS-G5 communication) and PVD (ITS-G5 only). Cross-border interoperability of the cellular system was tested by means of crossing a virtual border.

Gary Crockford, A2/M2 Programme Coordinator, Traffic & Technology Division, Department for Transport

'The InterCor project is important to the UK in demonstrating how connected vehicles could benefit road users and society. It examines the potential to improve safety, cut congestion, and minimize the environmental and economic impacts of traffic jams through delivering 'Day 1' services. Working with our partners in Belgium, France and the Netherlands (InterCor) to develop these interoperable systems helps inform policy makers and provide confidence for the automotive sector.'

Rijkswaterstaat

Louis Nelen, Anne Verwimp and Peter Lewyllie, Project Engineers Flanders InterCor pilot

'The InterCor project and cross-border TESTFESTs have provided essential input for us and our private partners for developing harmonized C-ITS services. We are looking forward to demonstrating the resulting pilot at the final Cross-border Interoperability TESTFEST in March.'


Cooperative
ITS Corridor
Joint deployment
Experience Week
CONNECTED
TRANSPORT
1-5 OCTOBER 2018
www.experienceweekconnectedtransport.nl

1.3 Cooperation and synergy

Dirk-Jan de Bruijn, Program Director Tulip Connected Transport, Rijkswaterstaat

'If we really want to implement smart mobility, to make the leap from start-up to scale-up, we need to organize it totally differently! I am convinced that technology will not be our greatest challenge; I am absolutely sure that the way we organize it will take our greatest efforts – far away from optimizing with a silo mentality – from the point of view of the total ecosystem. With a multi-disciplinary approach and shared goals. Thinking from the opportunities of social issues!'

C-ITS has an important international dimension because many of the market participants involved are focused on an international, sometimes global, market. C-ITS is also the next generation technology for further enhancing road safety. These developments can have impact in a local context in various ways, for instance geographically and socially.

In order to use the full potential of the private sector, it is important that government authorities, as a collective, work and learn together and function as a reliable and predictable partner for market parties. In this respect, it is necessary to focus not only on an international and national scale but also on a regional/local scale. The C-ITS project is collaborating with several other Smart Mobility projects and private and public parties, working on joint specifications, carrying out joint testing and sharing and exchanging building blocks.

Examples of such collaborations are

The Province of Noord-Holland
First joint testing of short-range communication on the provincial road N205 resulted in further collaboration within the Concorda project.

The Netherlands Vehicle Authority (RDW)
Developing a common PKI and joint testing in France with the other InterCor partners.

Experience Week Connected Transport
A convoy of trucks participated in RWW test runs on the C-ITS Corridor test bed on the A16 motorway.

Talking Traffic
During the Hybrid TESTFEST the cross-border interoperability of cellular services was tested. The implementation was based on developments from the Talking Traffic partnership.

The Province of Noord-Brabant
The Rijkswaterstaat test vehicle was jointly equipped with hybrid tools to execute verification and validation for GLOSA services for both the GLOSA pre-TESTFEST as well as the Hybrid TESTFEST.

AON SMART & Safe Convoy & Parking
Driving in front of a semi-self-driving convoy on the C-ITS Corridor test bed on the A16, the Rijkswaterstaat test vehicle sent messages to the convoy warning it of roadworks ahead. The instruction was generated by the C-ITS Corridor smart infrastructure.

'On your own you go faster but together you go further'.
That is definitely true for the C-ITS Corridor as the project team is working with InterCor and other initiatives in the Netherlands. In doing so we are complying with political objectives, joining forces will enable us to make a bigger, more important contribution internationally. It benefits our road users and our country when the Netherlands succeeds in translating its innovations internationally.

Evert-Jeen van der Meer, Industry Director Automotive, Aon Risk Solutions, Trade & Manufacturing

'In June 2018, a convoy of semi-self-driving cars equipped with cameras drove from Groningen via Helmond to Rotterdam touching the A16 test bed of the C-ITS Corridor. This event was an initiative of Aon's risk and insurance department, with the intention of initiating a public /private dialogue on the effects of Advanced Driver Assistance Systems (ADAS) on traffic safety. The convoy drove completely autonomously in sequence, using among other things Adaptive Cruise Control and the Lane Keeping Assist System. On the A16, the Rijkswaterstaat test vehicle joined the convoy and drove in front to inform all vehicles about roadworks ahead. As expected, the whole convoy adapted its speed, according to the speed instruction received from the Rijkswaterstaat test vehicle. The cooperation during this event proved that working together will accelerate the promotion (the use) of driving safety systems within fleets of large companies, mobility providers and the political establishment.'

Rijkswaterstaat

Arthur Rietkerk, Advisor Smart Mobility, Province of Noord-Holland

'Cooperation is important, but not always obvious. By working together / cooperating you know more and you can make progress, but always based on your own value and strength. Technical innovation is complex and can have a considerable impact on accessibility, quality of life and traffic safety. That's why we work together closely in the Metropolitan Region Amsterdam, especially on the themes of Smart Mobility and traffic management. We are working together on various projects and even go as far as to 'direct and use measures on each other's roads'.'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1.4 Selected key Lessons Learned

Capturing lessons learned on process as well as on technology is an ongoing effort throughout the project life cycle. In this paragraph we will discuss the key lessons learned up to the end of 2018, a year in which the international community was discussing several defining aspects of C-ITS. A year, also, in which the automotive industry announced further steps towards implementing new in-car C-ITS.

Together with project partners, public as well as private, we assemble lessons learned, hold lessons learned sessions, review lessons learned reports and make decisions on how to use the knowledge gained in the next steps.

Some key lessons learned have remained relevant and valid throughout

Early testing of building blocks in live traffic conditions will seriously accelerate learning curves. An adaptive approach is crucial.

Innovative projects with an adaptive approach still require rigid change and scope management.

Test, test, test! Successful results from national testing do not guarantee international interoperability.

Describing, recording and formalizing specifications of learning experiences gained during field tests with (international) partners turned out to be extensive and complex. This needs ongoing attention.

Participation in the InterCor PKI Security TESTFEST and the Hybrid TESTFEST resulted in a number of lessons learned, the key items of which were

Profiles
In order to reach interoperability, the establishment of a common specifications profile is fundamental.

Systems
Our systems need to be robust in implementation and certification.
Despite there being profiles and specifications, we need to keep in mind that there will be implementations that do not comply or that have a different interpretation.

Testing
We need to extend the OBU with a developer mode functionality so we can generate more technical background information.
During testing we could not determine the quality of the reception, the number of messages received or whether ITS-G5 or cellulair was used.

Evaluation
Follow up evaluation of pros and cons of the use of ITS-G5 versus cellular by cross-border testing in C-Roads. Define research questions and use a stable infrastructure.
Thanks to the use of the exact same data and format over ITS-G5 and cellular no integration issues occurred. We cannot, however, yet determine the advantages of using one system over the other.

Yvonne Dierikx, Test Project Leader & Axel Zandbergen, Test and Integration Manager, C-ITS Corridor project, Rijkswaterstaat

'A lot has been achieved so far! The core functionality of RWW, PVD, CRW and IVS has been investigated, specified, developed and tested. Additionally aspects such as costs, roadside and trailer variants, beacon placement, interoperability, security and hybrid communication have been analyzed and evaluated.'


What is ECo-AT?

C-ITS Corridor, a bird's-eye view

2013 2014 2015 2016 2017

ne 2013
ning of the
emorandum of
derstanding by the
nisters responsible
Austria, Germany
d the Netherlands

January 2014
Project plan discussed by the RWS Board of Directors

November 20 14
Start preparation RWS phase 1 of the Dutch part of the Corridor

LIVE EVENT #2

November
Interoperability test RWW in Germany
The first Dutch interoperal ility test in Germany

LIVE EVENT #1

November
Field test RWW on the A16 motorway near Dordrecht

LIVE EVENT #3

December
Field test RWW on th A58 infrastructure of the hock-wave traffic jams pro ect

M y
App roval to commence pro ect activities

October
First Corridor market day: Re-action Day, sharing views on the ITS Corridor

LIVE EVENT #4

March
econd Dutch inter-perability test RWW n Germany

April
Participating in Innovation Expo Amsterdam

July
Second Corridor market day: Recap RWW field tests and interactive workshops

LIVE EVENT #5

November
Field test RWW from lane closure trailers
The first time RWW messages were automatically generated by a Central Unit

LIVE EVENT #6

December
Field test Sensor data from vehicles (PVD), based on the 3rd party infrastructure for the A58 Shockwave traffic jams project

LIVE EVENT #7

I ebruary
F eld test CRW
F r the first time a Flister r essage was converted to a DENM message, in accordance v ith international standards

LIV EVEN #8

March
Field test RWW on a typical Dutch motorway with variable message signs (motorway management system)
The first demonstration in Europe of the transmission of IVI messages based on information from the back-end systems

April
First version of RSU Positioning Guidelines: guidelines to determine the position of cooperative roadside ITS stations

June
Press release Volkswagen: 'With the aim of increasing safety in road traffic, Volkswagen will enable vehicles to communicate with each other as from 2019'

LIVE EVENT #9

July
Organizing Dutch InterCor ETSI-G5 TESTFEST: validating the common set of specifications for existing services using ITS-G5
The first InterCor TESTFEST

LIVE EVENT #10

July
Field test ('Probebetrieb') in Germany: validating the interpretation of the ETSI-G5 signals from German safety trailers

September
Publication by the C-roads platform of the first release of a harmonized specification for cooperative services, the internationally aligned Dutch C-ITS Corridor Profile

November
Corridor NL event 'Accelerating Corridors': presenting results en lessons learned so far

2018

March
Participating in InterTraffic Amsterdam

LIVE EVENT #11

April
InterCor PKI Security TESTFEST in France: validating the interoperability of PKI solutions

LIVE EVENT #12

June
Cooperating with the Province of Noord-Holland for testing on the N205
The N205 is the first 'smart road' in the Netherlands, fully equipped with smart traffic lights

LIVE EVENT #13

June
Participating in SMART & Safe Convoy & Parking event

LIVE EVENT #14

June
InterCor pre-TESTFEST in Helmond: validating the interoperability of ITS Hybrid GLOSA services

June
Organizing international workshop Hessen: exchange of experiences amongst the Corridor partner countries

July
Nomination for the Dutch Computable Awards in the category 'Digital Innovation of the Year'

September
Participating in ITS World Congress Copenhagen
RWS Special Interest Session

LIVE EVENT #15

October
Participating in Experience Week Connected Transport: RWW test runs on the C-ITS Corridor, the A16 motorway

LIVE EVENT #16

October
InterCor Hybrid TESTFEST in the UK: testing I2V services operating in a hybrid combination of ITS-G5 and cellular communication systems
The cross-border interoperability of these services was tested by means of crossing a virtual border

November
Participating in ITS Forum Utrecht

December
Start up-scaling test vehicle fleet for InterCor pilot operations
Objective is to analyse elements and issues that influence the penetration and effective use of relevant C-ITS hybrid services

2019

January
Participating in InfraTech Rotterdam

LIVE EVENT #17

February
Participating in collaboration with Fiat Italy in a pre-test event for the Concorda project: testing on the Corridor test bed A16 motorway

LIVE EVENT #18

March
InterCor Cross-border Interoperability TESTFEST organized by Belgium: validating interoperability of all deployed C-ITS hybrid services
A three-week event of testing in the Netherlands, France, the UK and Belgium

June
Participating in ITS European Congress
Supporting the showcase 'Smart mobility Dutch reality'
Organizing visits to the A16 testbed during live traffic, to offer an experience of the latest results of the project

July
Start evaluation of data collected from the scaled-up test vehicle fleet

July
Up-scaling testbed A16 with LTE-V
Testbed prepared for next level live pre-testing

2 Currently working on...

Many tests have already been carried out and we have seen C-ITS systems becoming more and more mature. But will the systems also perform well for a longer period of time? In cars of normal road users? And how will these drivers respond to the systems? Will they actually react to the in-car warnings, like we expect them to? Or will the signals distract drivers from their primary driving task? Will drivers appreciate the extra information, or will they switch off the system?

Such questions can only be answered by carrying out a large-scale pilot with a representative group of drivers. Therefore, in 2019 we will focus on up-scaling the current pilot activities and evaluating them. But first, the fourth and final InterCor TESTFEST: a final check of the international interoperability of the C-ITS services during an extensive test drive through the UK, France, Belgium and the Netherlands. And then, green light for all drivers in the scaled-up pilot!

Rijkswaterstaat

Carel van Belois, Portfolio Manager, Rijkswaterstaat

'Innovative international projects like the C-ITS Corridor are very important for Rijkswaterstaat to take the necessary steps towards future-ready infrastructure on the Smart Mobility road map. The pragmatic 'learning by doing' approach used by our project team has afforded us a great deal of experience through trials and experiments. It helps us to improve our understanding of the international developments taking place and realize acceleration in other projects like InterCor and Concorda.'

Yvonne Dierikx, Test Project Leader & Axel Zandbergen, Test and Integration Manager, C-ITS Corridor project, Rijkswaterstaat

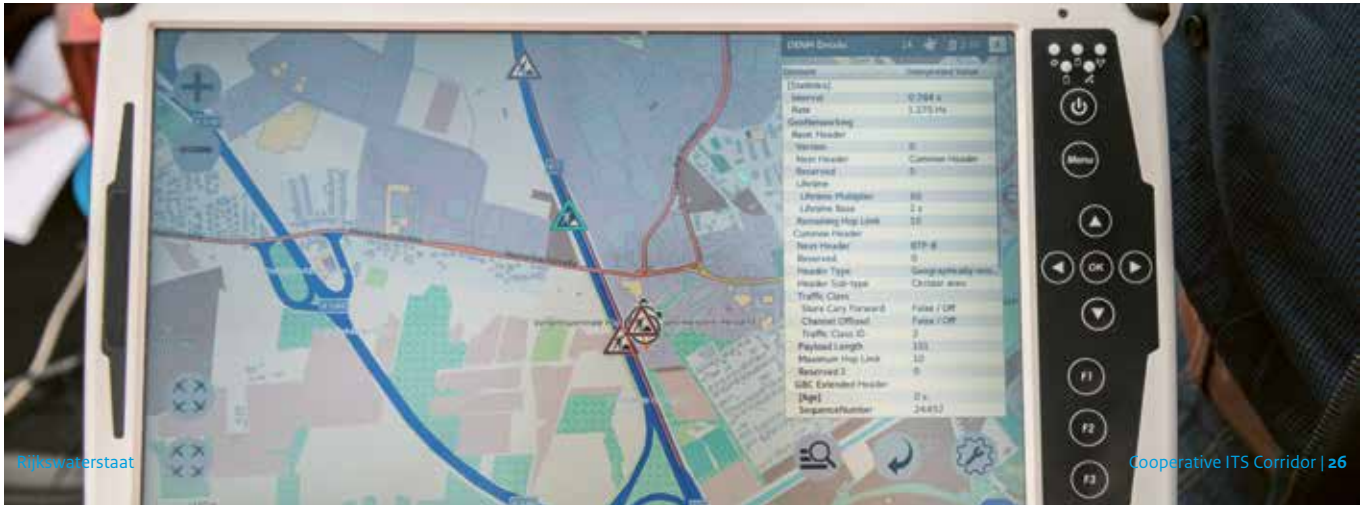
'The project is now focused on the next level: an automated integral system, in a live environment, cooperating with other road operators, operating for a longer period and with multiple non-expert users. This level is a necessary step in providing a solid basis for policy decisions on roll-out of ITS in the Netherlands!'

2.1 Preparing for InterCor Cross-border Interoperability TESTFEST

The Cross-border Interoperability TESTFEST is scheduled for March 2019. The main objective of this TESTFEST is to validate the international interoperability of the deployed Day-1 services.

The project team is preparing for the Dutch participation, with a single entry utilizing the Rijkswaterstaat test vehicle. The hybrid Day-1 services will be tested for Rijkswaterstaat, the GLOSA services for the Province of Noord-Brabant. All the necessary actions to get the relevant building blocks in place have been determined and scheduled in collaboration with participating private companies and the InterCor member states. An intensive test program is scheduled to run on the Dutch test bed on the A16 as well as on the test beds of the other member states.

To accommodate visiting testing parties, the A16 test bed is being aligned with the latest InterCor specifications and profiles. The test bed will deliver RWW and IVS services non-stop, both through WiFi-p roadside beacons, and via the standardized interface IF2 for cellular services as well. Messages transmitted from the roadside systems will be encrypted with PKI authentication technology.



Rijkswaterstaat

Rijkswaterstaat

2.2 Pilot Operations

The project team is preparing for the last part of the Pilot Operations. In 2018 a lot of test drives were carried out, mainly with the Rijkswaterstaat test vehicle, to prepare for the various TESTFESTs. The lessons learned from those events are being implemented in the infrastructure of the A16 test bed as well as in-car in the Rijkswaterstaat test vehicle. In the meantime, preparations for a test fleet and a comprehensive test scheme for extensive test runs and event test runs during the period March – July 2019 are in full swing!

Wim Vossebelt, CEO / Managing Partner V-tron

'The various TESTFESTs have once again made it clear that it is not easy to build a properly functioning C-ITS chain. The fact that all parts are functioning and are more mature does not mean that there is a working C-ITS chain. Keep an eye on the user and solve basic issues.'

Ron de Waard, Commercial Manager, Compass

'We believe partnering with the authorities is important because the C-ITS techniques at hand contribute directly to the Dutch infrastructure being in pole position and this is where it should remain. C-ITS is of strategic importance to us and this international collaboration presents insight into different interesting viewpoints other nationalities have on the future, which we can use to challenge our goals and choices.'

Freek van der Valk, Managing Director, Swarco Nederland BV

'Working on cooperative ITS also means working together as cooperative partners in these projects. Within the C-ITS Corridor we are working closely with public and private partners to demonstrate that interoperability works due to these joint efforts. Technology and functionality at the forefront are demonstrated live, based on European standardization and profiles. It's a great pleasure for us at Swarco to be part of this cooperation.'

Rijkswaterstaat

2.3 User acceptance

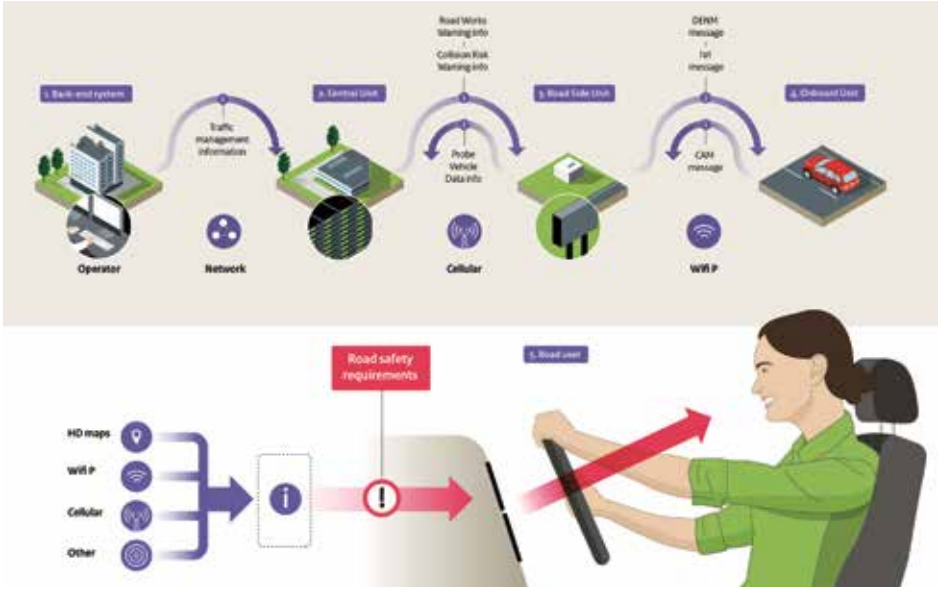
During the Pilot Operations, the project will analyze elements and issues that influence the penetration and effective use of relevant C-ITS Services like RWW and IVS and therefore, indirectly, the impact of such services on road safety and traffic effectiveness in general terms. The objective is to execute and evaluate user acceptance in order to gain insight and to provide a basis for recommendations.

An international, comprehensive plan is currently being developed, describing the approach for getting answers to the most important research questions, such as

- Road Works Warning
  - How do drivers change their behavior when a warning/ information is communicated by the service?
  - Do drivers slow down earlier after receiving a roadworks warning?
  - Do drivers drive in a less erratic way after receiving a roadworks warning?
  - Do drivers comply with the advice communicated by the service?
- In-Vehicle Signage
  - Do drivers comply with the speed limit after receiving the information?

2.4 Impact assessment

Innovative projects often seem to focus only on technology. And indeed, in the C-ITS Corridor project a big part of the work also concerns the development and first implementation of new technology. However, in the end the new technology is only a means to achieve certain goals. It is assumed that the introduction of C-ITS will contribute to road safety, traffic flow and sustainability. The pilot on the C-ITS Corridor enables the collection of data in live traffic, in order to see whether this positive impact can be confirmed (and estimated) in practice in the Netherlands. Given the C-ITS services trialed in this pilot, the emphasis will be on road safety.



2.5 Technical evaluation

Within the InterCor project a methodology for technical evaluation has been developed. This has resulted in specifications for the evaluation criteria and analysis for indicator calculation, event and situation detection, and data provisioning and management. An important Dutch building block for collecting relevant data for that technical evaluation is the Corridor test bed on the A16 motorway.

Fred Verweij, Senior Advisor, Rijkswaterstaat

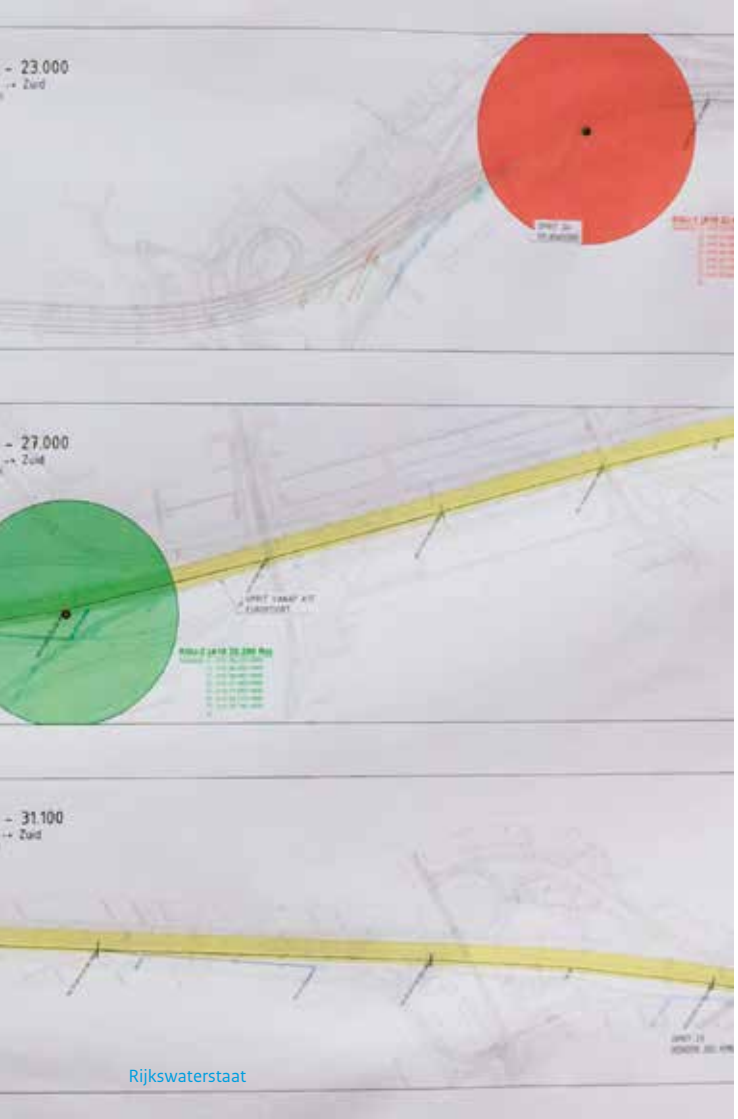
'In theory it is very well possible to harmonize international C-ITS services by discussing standards, but trials in practice bring real progress!'

The main objectives for the technical evaluation are

- Demonstrating and evaluating large-scale cross-border interoperable deployment of C-ITS.
- Measuring performance of services in live traffic situations
- Providing ITS services on a broader scale using hybrid communication.
- Extending the strategic cooperation between C-ITS front-running countries and assisting other member states to get on board.
- Evaluating the actual benefits of C-ITS applications.

3 Deliverables

Working towards providing the deliverables that were set for the C-ITS Corridor as well as the InterCor project, is an adaptive process that will take place throughout the project life cycle. Deliverables can therefore be met at different points in time, some may be provided as an intermediate result, possibly to be updated at a later date.



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3.1 National Key Deliverables

Much of the outcome from the work on the C-ITS Corridor will help our policy-makers prepare decisions about the next steps in Smart Mobility solutions.

Results which have already been published or will be published at a later date, concern

- Functional specifications of parts of the technical chain.
- Functional description of PKI and PVD.
- A Rijkswaterstaat information architecture for C-ITS services.
- Functional requirements concerning the Day-1 services and organizational aspects for Rijkswaterstaat.
- Placement guidelines for RSUs.
- Cost scenarios for possible future roll-out.
- Documents for knowledge dissemination.

3.2 International key deliverables

Results from the work on the Corridor, which have already been published or will be published at a later date, concern

- Internationally aligned specifications for ITS-G5, hybrid communications and PKI.
- The description of the pilot operation on the C-ITS Corridor.
- Lessons Learned with regard to the preparation of the pilot operation on the C-ITS Corridor.
- The technical evaluation of the pilot on the C-ITS Corridor.
- The impact assessment and user acceptance of RWW and IVS in the pilot on the C-ITS Corridor.

Hacene Fouchal, Professor in Computer Science at the Université de Reims Champagne-Ardenne

'Standardization institutes like ETSI work on detailled specifications for C-ITS. This institute usually launches plugtests to check the validity of specifications. However, these plugtests only cover some parts of the C-ITS functioning. Testing in live traffic, as well as cross-border, offers complementary feedback about C-ITS specifications and the way they are interpreted by different partners. In the end, the ETSI use the feedbacks given by the series of live testing to enhance specifications in order to improve the confidence of C-ITS actors.'


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4 What's next?

What are the next steps? To further identify how the future intelligent infrastructure should be defined? To focus on delivering input for further international alignment of specifications? Or to resolve technological uncertainties, in particular around security, profiles and cross-border? The answer can only be: all of the above! Past as well as future project efforts and activities are based on what they can contribute to future-proofing Smart Mobility.

4.1 Upcoming events

Cross-border Interoperability TESTFEST

As mentioned before, the project will participate in the InterCor Cross-Border Interoperability TESTFEST in March 2019. The main question to be answered is: how interoperable are the implementations of the member states?

Validation is done by testing the interoperability of user devices (Vehicle ITS stations or OBUs) from the four member states at each other's pilot location(s). Third parties will also be able to test their implementations on interoperability during the InterCor pilots. The services will be assessed at a functional (primary) and technical (secondary) level. This assessment will allow a technical validation of the pilot implementations and a validation of the actual interoperability between the several pilots in the four member states. There are eight test site locations spread out between the InterCor member states.

Different scenarios will be tested and demonstrated along with the following services

- RWW using DENM messages
- IVS using IVI (In-Vehicle Information) messages
- PVD (ITS-G5 only) using CAM and DENM messages
- GLOSA using CAM, SPAT and MAP messages
- Multimodal Cargo Transport Optimization
- Truck Parking

ITS European Congress

The thirteenth ITS European Congress, the largest event entirely dedicated to Smart Mobility and digitalization of transport, will take place in the Eindhoven Brainport region in June 2019. In addition to exhibiting as part of the 'Dutch Street', the project team will be involved in several activities revolving around this event.

Showcase

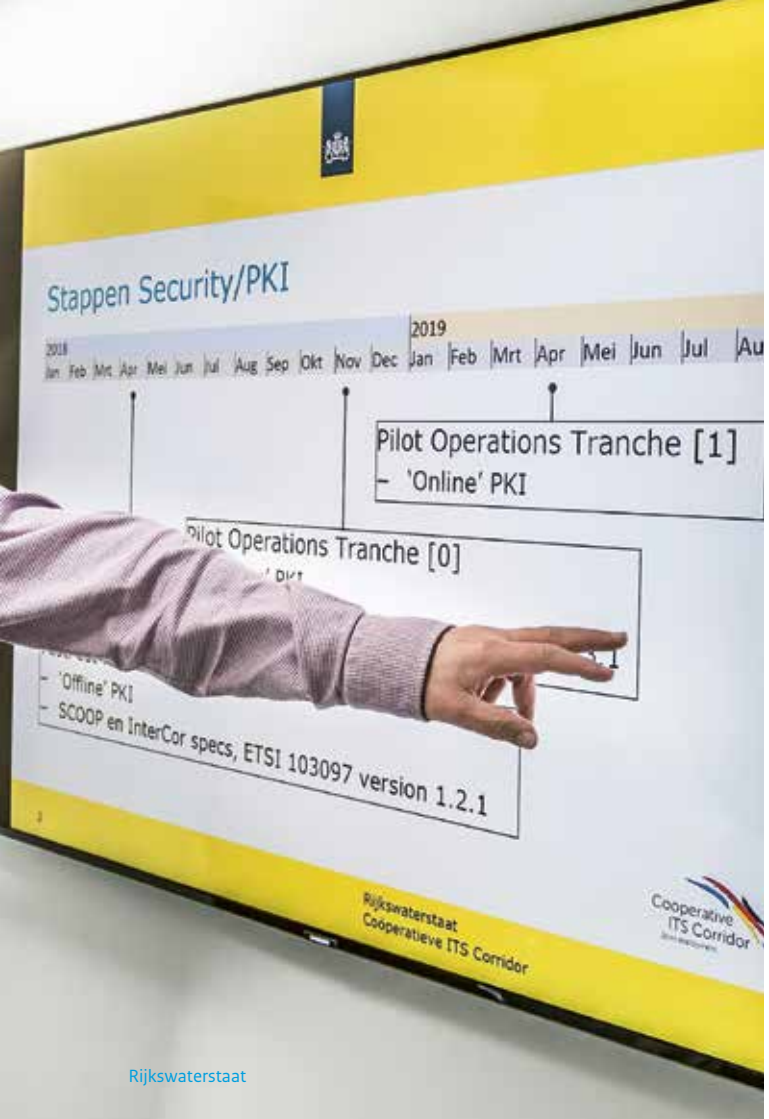
We are cooperating with a number of parties such as the Dutch Ministry of Infrastructure and Water Management, the Provinces of Noord-Brabant and Noord-Holland and TNO (The Netherlands Organization for applied scientific research) in order to put together the showcase 'Smart mobility Dutch Reality'.

Technical Visit

The ITS European Congress offers congress visitors the opportunity to visit several Smart Mobility projects.
The project team will be hosting a technical visit to the C-ITS test bed on the A16. Visitors will be given a unique opportunity to experience several complex, automated running ITS-services on one of the most complex parts of the Dutch motorway network, in live traffic. Services like RWW, CRW, PVD and Traffic Jam Ahead Warning will be running on a PKI-based road infrastructure implemented with the latest international harmonized standards. Visitors will experience Dutch solutions on Smart Mobility that contribute to safe, smart and sustainable traffic and transport, as a major step towards automated driving.

Special Interest Sessions

In collaboration with C-ITS Corridor partners Austria and Germany an interactive, tailor-made Special Interest Session has been proposed, touching on subjects such as the current state of affairs with regard to implementation on the C-ITS Corridor and future challenges.



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4.2 Upgrade C-ITS testbed A16

In preparation for automated driving field tests in the Amsterdam area by the Concorda project, pre-testing will take place on the A16 test bed. In order to facilitate knowledge building and pre-testing we will start to integrate the latest LTE-V mode 4 technology from the summer of 2019.

4.3 Pilot Operations

Fleet

During the last part of the Pilot Operations an extensive test fleet will be used to gather a great deal of evaluation data. We will utilize fifteen test vehicles and specially recruited test drivers. The specially equipped Rijkswaterstaat test vehicle will be used for verification and validation purposes. The basis of the test fleet further consists of ten test vehicles from the Rijkswaterstaat pool stock, designated for friendly users. This means that employees of Rijkswaterstaat will drive those cars on the A16 test bed during their daily commute.

On top of that, a few employees from participating companies have already kindly volunteered to test drive as well. And last but not least: two daily operational road inspector vehicles will participate from their home base 'Rijkswaterstaat Steunpunt Dordrecht' near the A16 and will thus be added to the fleet.

The test drives will be a combination of day-to-day driving and controlled tests. The event test runs will take place 24/7 and when, for instance, roadworks, lane closures and traffic jams are taking place.

Data evaluation

To enable the harmonization of evaluations across TESTFESTs and the pilot operation sites in the member states, data analysts and evaluators will have harmonized access to all evaluation data. This is necessary to enable cross-assessment and comparisons of the evaluation results as well as quality assessment of the input data and analysis results, such as calculated indicators, events and situations.

The data evaluation framework to be executed during the Pilot Operations will consist of three steps

1. Pilot sites to provide data
2. Assessment of the quality of the data provided
3. Management of the data provided and evaluation of the results

Based on the InterCor common data logging format, the Dutch team has collected data from all TESTFESTs and pre-tests on the A16, A58 and A67. In the coming period additional data will be captured from test runs during the scaled-up Pilot Operations. In order to manage the process, the test vehicle data will be captured from a distance and secured on a specially designed repository.

4.4 Presenting results

All joint international activities have yielded a large amount of information. During the coming period the results of the C-ITS Corridor and InterCor project will be collated based on national and international agreements and commitments. The results will also be discussed in separate international strategic committees of both projects. And of course we will present the key findings in our next booklet!

Michiel Beck, Project Manager ITS, Ministry of Infrastructure and Water Management

'By participating in the various TESTFESTs we learn so much that we can utilize for the hybrid communication approach, through our own contribution and through the contribution of our international partners. This is important input for the Netherlands, on its way to a future-proof infrastructure as part of the 'Dutch Reality'.'


Rijkswaterstaat


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Joint deployment

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