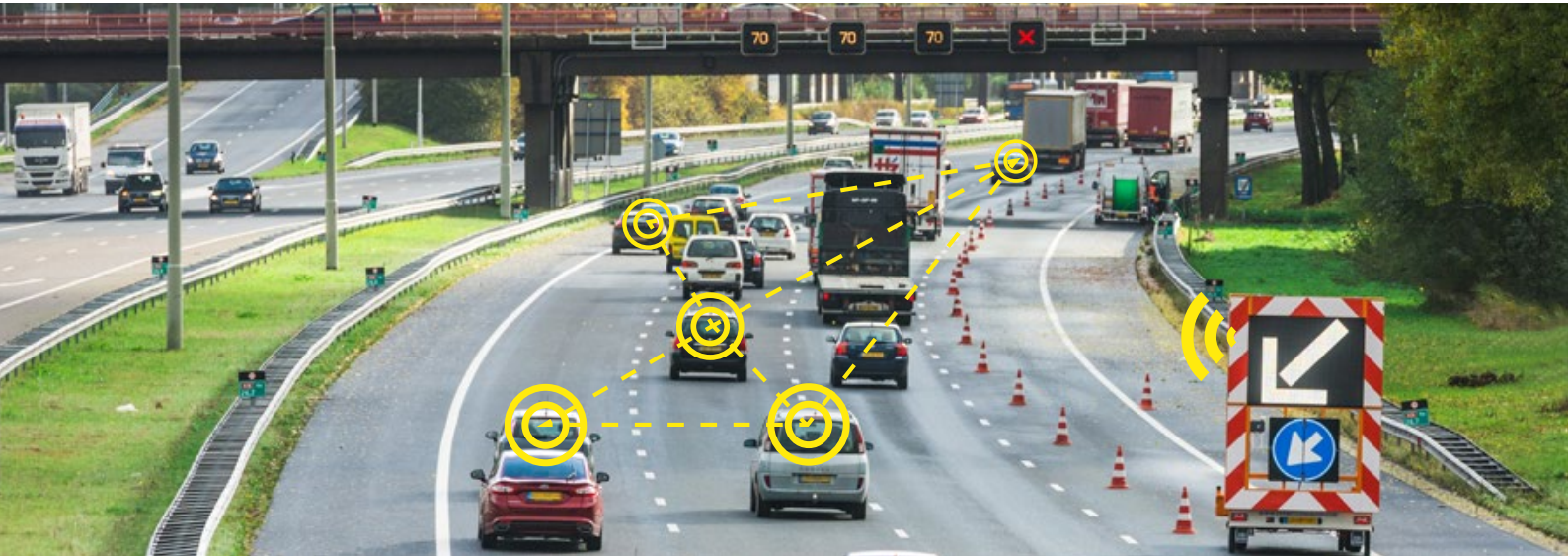
Rijkswaterstaat
*Ministry of Infrastructure and Water Management*

An overview of phase 2: Pre-deployment(s)

# Cooperative ITS Corridor




Cooperative
ITS Corridor
Joint deployment

# The future is now!

*"To boldly go where no man has gone before."* Important words, spoken by Captain James T. Kirk. Important for the future of mankind in the Star Trek series of which I am a big fan – and important for the Cooperative ITS Corridor project, with the Rijkswaterstaat mission to explore strange new technologies designed to improve the future of Smart Mobility and the people that will benefit from it.

Even in an apparently technology-driven international project like the Cooperative ITS Corridor it is people's dedication, perseverance and enthusiasm that make things happen! I truly believe that all people involved contributed to the great results achieved in this project so far. In phase 2 we recently realized four field tests in real live traffic situations, the so-called pre-deployments. And we concluded phase 2 with the successful TESTFEST last July in which almost twenty, mostly international, public and private organizations participated. For several days, these participants tested ITS-G5 specifications for a number of Day-1 C-ITS services in operational traffic on the ITS Corridor section of the A16 motorway near Dordrecht. Result? A first C-Roads approved profile!

*So, how about a rollout on the Dutch section of the ITS Corridor?* The automotive industry intends to launch consumer cars with ITS-G5 equipment in the near future. Initiated by Volkswagen who, as from 2019, plan to start fitting their vehicles with technology that enables them to communicate with each other and the local environment with the aim of increasing safety in road traffic. That said, there are still some technical, organizational and legal issues to resolve. To that end and in order to remain in the driver seat all the way, we intend to further accelerate our efforts in the next phase and stay focused on actual rollout.

With this booklet we want to give you an overview of the progress of the C-ITS Corridor project: main objectives, results and lessons learned. We hope you enjoy reading it!

Abraham Bot
Project Manager C-ITS Corridor

# Introduction

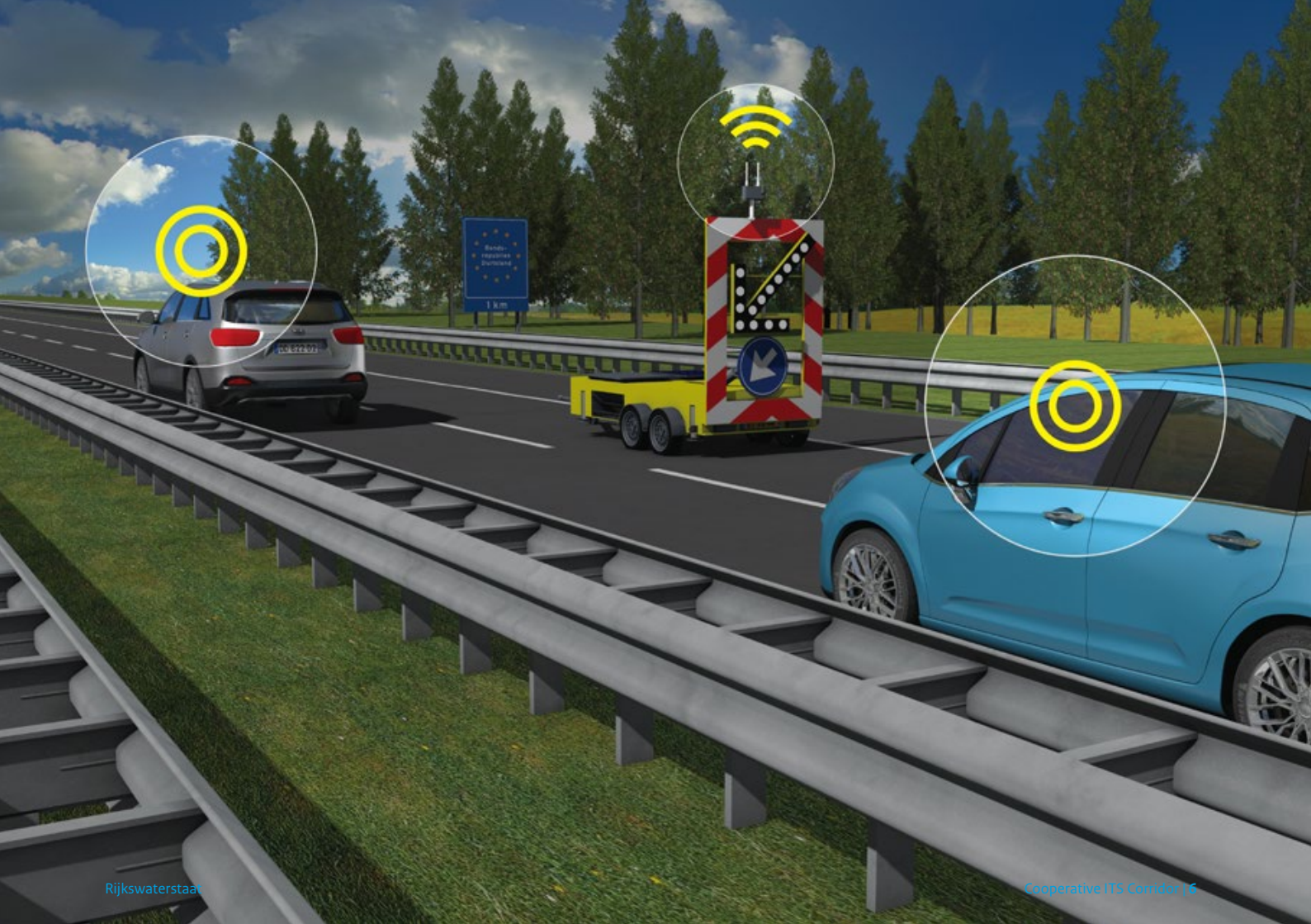
New communication technologies provide opportunities for greater safety, fewer incidents and traffic jams and more efficient use of the road network, which helps us to reduce $CO_2$ emissions.

In the near future, connected cars will be able to communicate with each other and with the road infrastructure. This technology will provide road users with real-time information about the situation on their route. This means they can anticipate even better with regard to for instance traffic jams, hazardous locations, road works and slow or stationary vehicles. Using probe vehicle and infrastructure related data, all cooperative services will be transmitted directly into the vehicles in such a way that users will get information without distraction. Finally, through these new technologies road operators can also improve their traffic management.

## The Cooperative ITS Corridor

The Cooperative ITS (Intelligent Transport Systems) Corridor project is based on a cooperation agreement between Austria, Germany and the Netherlands. The Memorandum of Understanding with regard to this cooperation was signed by the responsible ministers of the three countries on 10 June 2013. The C-ITS Corridor project is the first step towards the first international and cross border implementation of cooperative services. Joint deployment on the corridor Rotterdam-Frankfurt-Vienna is the final objective.


Rijkswaterstaat
Cooperative
ITS Corridor


1 km

## InterCor

The InterCor project started at the end of 2016, parallel to the C-ITS Corridor project. InterCor stands for Interoperable Corridors, linking the ITS Corridor initiatives of the Netherlands, France, the United Kingdom and Belgium. Together these countries will develop a sustainable network of corridors, providing C-ITS service continuity and offering innovative facilities for Day-1 C-ITS service development and beyond. The goal is to enable vehicles and related road infrastructure to communicate data using ITS-G5, cellular or a combination of both technologies. The overall goal is to make the mobility of people and goods safer, more efficient and more convenient.

*Michiel Beck, Ministry of Infrastructure and Water Management, DG Accessibility*

*"The concept has taken another major step forward. When we signed the Memorandum of Understanding with Germany and Austria we had an idea: we are going to implement a Day-1 service. We have come across a lot of issues and we have already solved a lot of them. It is great that the C-ITS project is connecting knowledge and other projects and so contributes to the acceleration of Smart Mobility developments within Europe."*

## Services

In the Netherlands, Rijkswaterstaat is responsible for the implementation of both projects and works together with interested parties to develop common specifications for cooperative services:

- Road Works Warning (RWW), a secure and dedicated WiFi connection provides drivers with detailed and timely information about road works
- Probe Vehicle Data (PVD), new in-car equipment provides traffic information centres with anonymized information about road and journey conditions

Two supplementary services are also being developed in the Netherlands:

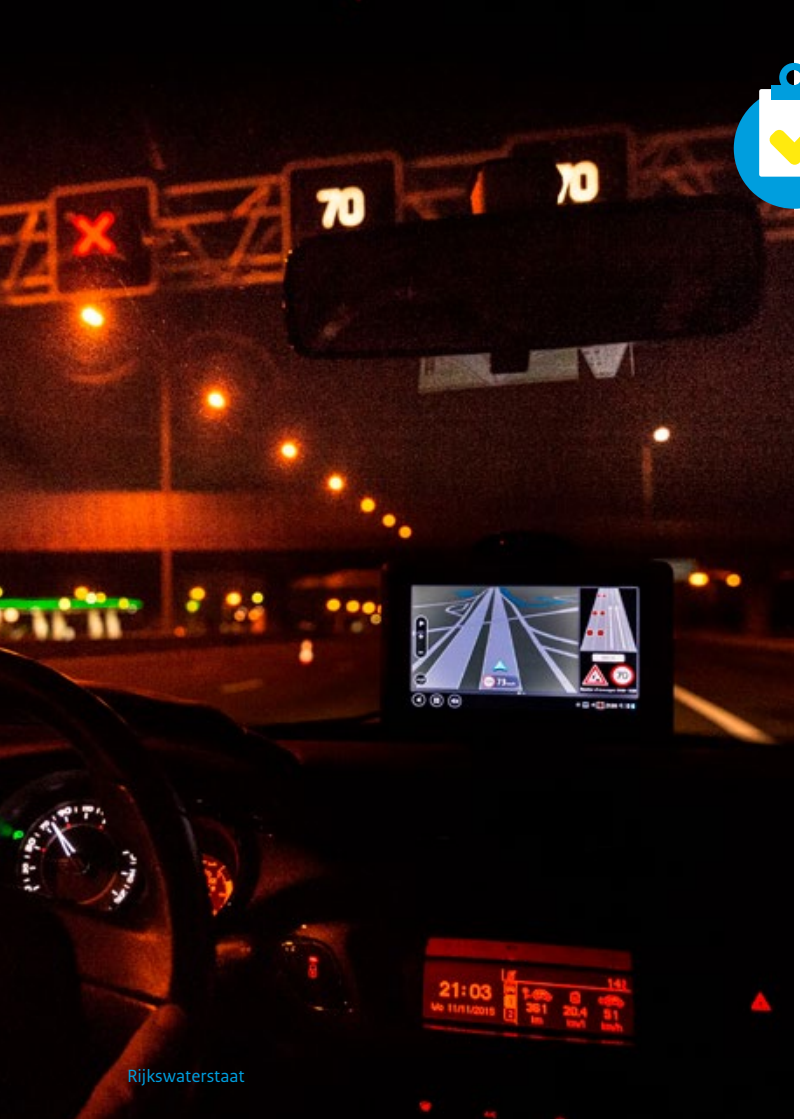
- Collision Risk Warning (CRW), alerts road users to stationary vehicles used by road inspectors
- In-Vehicle Signage (IVS), communicates information from both static and dynamic signage to vehicles

The C-ITS Corridor project focuses on the introduction of these services as soon as possible. But it also aims to provide the base for a range of other cooperative services that will become available in a couple of years. The project has a hybrid approach: the services are also being delivered through service providers using cellular technology.

# 1 Recap phase 1: **Research**

Phase 1 of the C-ITS Corridor project started in November 2014. The key objective for phase 1 was:

'Research and development of the two cooperative services Road Works Warning and Probe Vehicle Data, which will in time be available on the Dutch part of the ITS Corridor Vienna – Frankfurt – Rotterdam. Development of these services will be done in close operation with Germany and Austria, as agreed upon in the Memorandum of Understanding.'




Rijkswaterstaat

# 1.1 Results phase 1

The project successfully demonstrated the RWW service on two occasions:

## Field test in a real-life setting on the A16 motorway

In November 2015, the project demonstrated the RWW service for the first time on the A16 motorway near Dordrecht. This location represents one of the most complex traffic situations in the Netherlands. During this field test, a temporary change in lane layout was presented in real time in two test vehicles which passed the road works site several times. The road works were displayed in the vehicle and the temporary traffic management measures were displayed on an On Board Unit. Two communication systems were used for this, cooperative (based on ETSI-G5 communication technology) and “connected” (based on cellular technology).

Shortly after the demo on the A16, the project took part in a first interoperability test in Germany. During this test, German RWW messages were successfully received in a Dutch test vehicle. Communication technologies from a number of suppliers were also tested in this setting ("cross-testing").


## Field test/demo on the A58 motorway

In December 2015, the project demonstrated the RWW service on the A58 infrastructure of the Shockwave traffic jams project. This was the first field test/demo intended as a major step to a production-ready service. The test did not yet include connection to the central systems in the traffic centre.

The Probe Vehicle Data service was largely developed in phase 1, but not yet demonstrated because of several complex unresolved issues in the technical chain in relation to Security.

## Complementary activities

During this phase, the C-ITS Corridor project also developed a number of activities relating to coordination and harmonization with other cooperative projects, partner countries, authorities, market parties and knowledge institutions. For instance, in October 2015 the project hosted its successful market day "Re-Action day: Sharing Views on the ITS Corridor". During this event the project presented and discussed views and ideas on the basis of a first set of specification documents.


Rijkswaterstaat

## 1.2 Selected key Lessons Learned

- Innovative projects can only be successful if you have large and small (niche) market players working together
- This ITS project does not have a traditional technical scope. There are cases that are out of scope in the sense of "to build or to develop" but that are crucial for the entire chain. During the development of the RWS parts (road side, IV) interaction with these out of scope cases is required
- Functioning intermediate results (demos, field trials) effectuate a serious acceleration in terms of understanding and learning curve. An 'agile-like' approach is crucial
- The working method with regard to the published system specification, where we focused on functionality and the use cases to be realized, has proven to be the right approach, which was confirmed by the market

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

2013 2014 2015 2016 2017

JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC JAN

**June 2013**
Signing of the Memorandum of Understanding by the ministers of Austria, Germany and the Netherlands

**November 2014**
Start preparations of Rijkswaterstaat phase 1 of the Dutch part of the Corridor

**December 2014**
Completion of project plan

**May 2015**
Approval for phase 1

PRE-DEPLOYMENT LIVE EVENT NO. 1

**November 2015**
Field test RWW on the A16 motorway

PRE-DEPLOYMENT LIVE EVENT NO. 2

**November 2015**
Interoperability test RWW in Germany
*The first Dutch interoperability test in Germany*

PRE-DEPLOYMENT LIVE EVENT NO. 3

**December 2015**
Field test RWW on the A58 infrastructure of the Shockwave traffic jams project

**October 2015**
First Corridor market day:
*Re-action Day, sharing views on the ITS Corridor*

PRE-DEPLOYMENT LIVE EVENT NO. 4

**March 2016**
Second Dutch interoperability test RWW in Germany

**April 2016**
Completion of action plan phase 2: 'Pre-deployments'

**April 2016**
Participating at Innovation Expo in Amsterdam, also in the context of (the end of) the Dutch EU presidency

PRE-DEPLOYMENT LIVE EVENT NO. 5

**November 2016**
Field test RWW from lane closure trailers
*The first time RWW messages were automatically generated by a Central Unit*

**November 2016**
Approval for discharge phase 1 and start phase

**July 2016**
Second Corridor market day:
*Recap RWW field tests and interactive workshops*

PRE-DEPLOYMENT LIVE EVENT NO. 6

**December 2016**
Field test Sensor data from vehicles (PVD), based on the existing hardware for the A58 Shockwave traffic jams project

2017

PRE-DEPLOYMENT LIVE EVENT NO. 7

**February 2017**
Field test CRW
*A new development was that the Flister message was also converted to a DENM message, based on the international standard*

PRE-DEPLOYMENT LIVE EVENT NO. 8

**March 2017**
Field test RWW on a typical Dutch motorway with information displays
*The first demonstration in Europe of transmission of IVI messages based on information from the back-end systems*

**April 2017**
Completion of RSU Placement Guidelines: guidelines to determine the position of cooperative roadside ITS stations

**May 2017**
International Strategic Corridor Partners meeting Amsterdam

**May 2017**
First webinar for participants of the Dutch InterCor ETSI-G5 TESTFEST

**June 2017**
Press release Volkswagen: 'With the aim of increasing safety in road traffic, Volkswagen will enable vehicles to communicate with each other as from 2019'

**June 2017**
Second webinar for participants of the Dutch InterCor ETSI-G5 TESTFEST

PRE-DEPLOYMENT LIVE EVENT NO. 9

**July 2017**
Dutch InterCor ETSI-G5 TESTFEST: validating the common set of specifications for existing services using ITS-G5
*The first InterCor TESTFEST*

PRE-DEPLOYMENT LIVE EVENT NO. 10

**July 2017**
Field test (Probebetrieb) in Germany: validating the interpretation of the ETSI-G5 signals from German lane closure trailers during real road works. 'Security' also inplemented in the ETSI-G5 signals

**September 2017**
Publication by the C-roads platform of the first release of a harmonised specification for cooperative services, the internationally aligned Dutch C-ITS Corridor Profile

**October 2017**
International Strategic Corridor Partners meeting Frankfurt

**November 2017**
Completion of project plan next phase 'Rollout Preparation' and discharge phase 2

**November 2017**
'Accelerating Corridors' event in Utrecht

2018

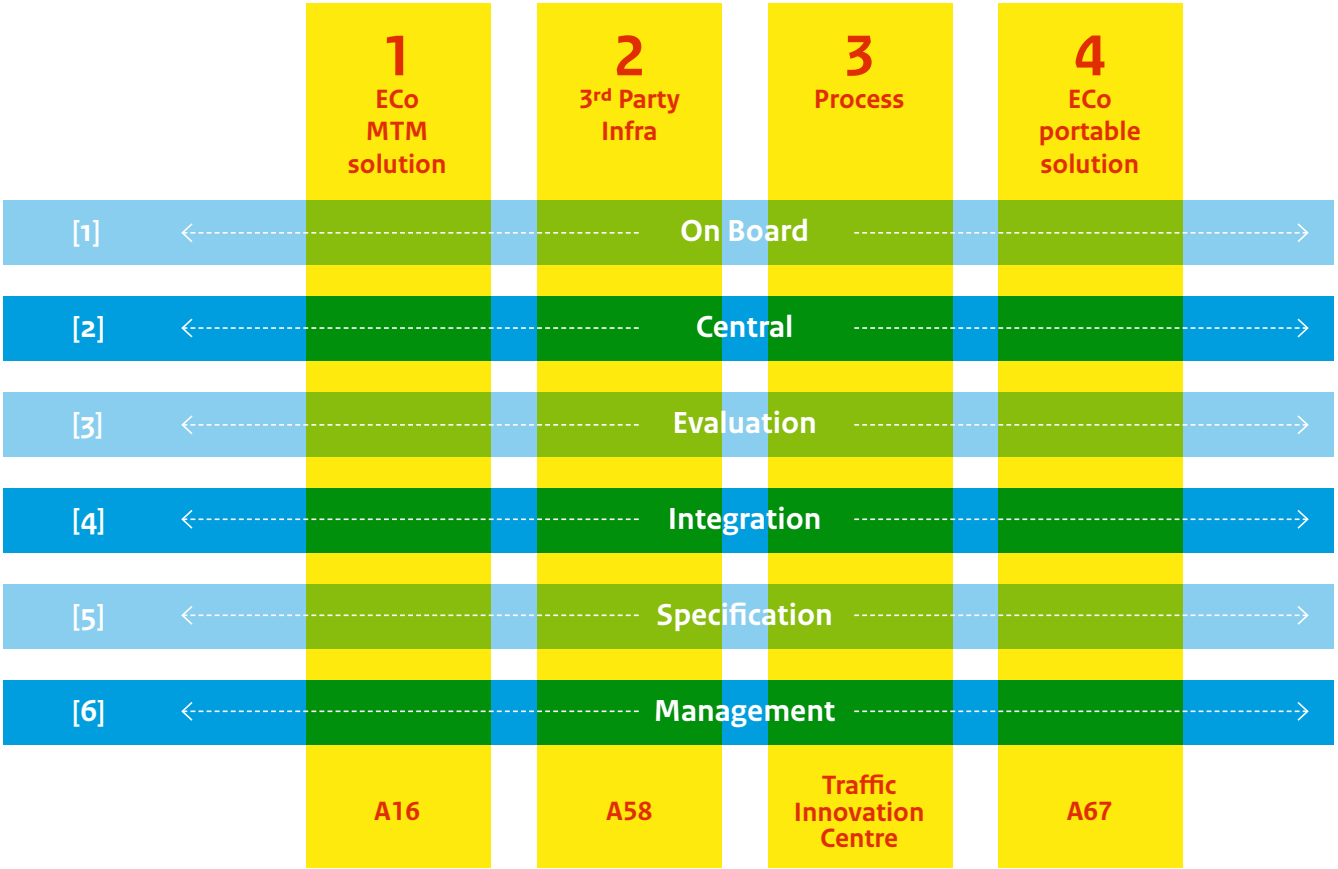
FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC

# 2 Phase 2: **Pre-deployment(s)**

The Dutch Ministry of Infrastructure and Water Management gave its formal agreement for the second phase of the C-ITS Corridor project in November 2016. Despite the remaining uncertainties phase 2 was mainly about taking concrete steps with regard to the implementation of cooperative services, in line with the German 'Probebetrieb' (pilot operations). The project focused on four so-called pre-deployments in combination with a number of supporting work packages. The objective for phase 2 was:

'Acquire proven (international) practical experience through a smart combination of existing and new technologies for interoperable and scalable new services (RWW, PVD and CRW) for road users and road operators, based on the results of phase 1.'

This objective was converted into a number of sub-objectives and learning questions.


1
ECo
MTM
solution
2
3rd Party
Infra
3
Process
4
ECo
portable
solution
[1]
On Board
[2]
Central
[3]
Evaluation
[4]
Integration
[5]
Specification
[6]
Management
A16
A58
Traffic
Innovation
Centre
A67

# 2.1 Field tests

The project tested the cooperative services step-by-step in a number of field tests: the four pre-deployments and the first InterCor TESTFEST.

*Marja van Strien: Programme Director Connecting Mobility*

*"It involves a lot of complex technology and the project team has managed to make it work first in the Netherlands. So we are in the lead again and it is great that the messages are internationally standardized. That is a great outcome and deserves a compliment."*

PRE-DEPLOYMENT 1

## ECo MTM Solution: Road Works Warning on a typical Dutch motorway with information displays

The RWW service was tested for the first time in phase 1, in November 2015 on the A16 near Dordrecht. In a second step, the project undertook a further test in March 2017, based on the lessons learned from the first test. During this second test Road Side Units (RSU) transmitted not only Decentralized Environmental Notification Messages (DENM) to passing test vehicles but also In-Vehicle Information (IVI) messages based on the recently adopted international standard. The DENM messages contained the exact position of the road works and the IVI message the information presented on the displays over the road.

### Results

The information transmitted during the test was provided by several Rijkswaterstaat systems and automatically generated by a Central Unit (CU). The generated messages complied with the specifications of the Dutch profile and the international profile agreed with Germany and Austria. This was the first transmission of IVI messages based on information from the back-end systems. Hence the Netherlands was the first European country to demonstrate this service during real road works. A unique result.


*Abraham Bot: Project manager Cooperative ITS Corridor, Rijkswaterstaat*

*"We are doing this in live traffic situations on the A16 because that is a complex road section with many merges and demerges, many lanes, and complex traffic engineering. So only testing step-by-step in live traffic situations will help us to learn quickly and identify applicable uncertainties for the next steps."*

PRE-DEPLOYMENT 2

## 3rd Party infra: Sensor data from vehicles, based on the existing hardware for the A58 Shockwave traffic jams project

In December 2016, the A58 Shockwave traffic jams project and the C-ITS Corridor project, supported by the Province of North-Brabant, carried out a successful validation test of the Sensor data from vehicles service (PVD). The recently, by the project team developed specifications for the service were used and validated using the existing WiFi-P infrastructure along the A58.

Rijkswaterstaat

## Results

During the test, coordinated by the Traffic Innovation Centre at Helmond, the On Board Units of passing test vehicles transmitted messages containing information about the vehicle, such as its position and speed. The messages were received over the ETSI-G5 WiFi-P connection. Test vehicle messages were also transmitted over the mobile 3G/4G networks. This was done using the existing ZOOF app of the A58 Shockwave traffic jams project. The messages, transmitted by the test vehicles, could be interpreted correctly. A web viewer was used to present the exact positions and routes of the test vehicles real-time.

*Paul Bevers, Project Manager, the Province of Noord-Brabant*

*"The cooperation has been perfect on different levels, such as technical and project management. This combined effort is the right way to get things going. Individual interests were put aside and issues were resolved. We have been facing a few problems but we have solved them together and we can all be very proud of that."*


Snack & Shop
Délifrance
Diesel
Euro

## PRE-DEPLOYMENT 3

### Process:
### Analysis of the impact on existing traffic management processes and the operation of the Collision Risk Warning service

In February 2017 the project tested the CRW service on the A67 motorway, once more coordinated from the Traffic Innovation Centre in Helmond. A Rijkswaterstaat road inspector activated the existing Flister service from his vehicle. A new development was that the Flister message was also converted to a DENM message, based on the international standard. This message, containing information about the location of the vehicle, was then transmitted directly from a RSU to passing test vehicles using a WiFi-P beacon.

### Results

During the test Flister messages were correctly received over WiFi-P by the test vehicles, including a specially prepared standard Rijkswaterstaat company car. The message was received by the vehicles at the expected location and time. Now that the service was demonstrated, the impact of the service on the operational traffic management processes of Rijkswaterstaat can be further assessed.

*Chris van Hoften, Road inspector, Rijkswaterstaat*

*"I enjoy being involved in this test. Flister is very important to us. Safety is really important so this is a positive development."*

*Peter Hoernig; project leader Pre-deployment 3, Rijkswaterstaat*

*"Today we are focussing on Collision Risk Warning, to warn road users about accidents. Flister is already operational, based on existing technology. Right now we are testing if the WiFi-P messages reach the cars."*

PRE-DEPLOYMENT 4

## ECO Portable solution: Road Works Warning from lane closure trailers

In November 2016, during road works on the A16 motorway near Rotterdam, a mobile implementation of the RWW service was tested. The mobile implementation is particularly suitable for motorways and other roads without variable message displays. It is similar to the solution being developed in the German Corridor project.

A lane closure trailer was fitted with a WiFi-P beacon for this test. The beacon used a secure WiFi-P link to send detailed information about the upcoming road works to passing test vehicles. The messages used in this test also complied with the specifications of the Dutch profile.

### Results

The short range communication between the beacon and the test vehicles performed effectively. The test primarily focused on the radio reception range of the beacon and correct reception of the DENM message by the On Board Units in the test vehicles, even in heavy traffic. It was concluded that further development was required. This was also the first time that messages about the road works were automatically generated by a specially developed Central Unit, based on information from several sources.

*Guido Hagemann: Director Production and Project Management PPO, Rijkswaterstaat*

*"The future is now. It is great to be able to see the future right now. From plans to practice – brilliant"*


Aricent
2203
Aricent

Rijkswaterstaat

TESTFEST

## Validating the common set of specifications for existing services using ITS-G5

The C-ITS Corridor project co-organised and hosted the first InterCor TESTFEST, a large-scale validation event on the C-ITS Corridor section A16 near Dordrecht in the Netherlands. The TESTFEST took place from 3 to 6 July 2017 and focussed on ITS-G5 services.

A large number of international public and private organizations tested ITS-G5 specifications for a number of Day-1 C-ITS services during regular traffic conditions. RWW, PVD and IVS services were available via fixed RSUs for testing both in representative lab environments and real-world complex traffic conditions with real road works.

*Ronald Adams, InterCor Project Manager*

*"We choose an operational environment because this is what we really do. Testing in operational traffic. Not only with Dutch people and Dutch companies, but with almost 20 international companies."*

InterCor

Co-financed by the European Union
Connecting Europe Facility

*Gary Crockford, InterCor UK*

*"This is an incredibly important project-event for the UK. It's driving what we are doing in our national pilot, which is the A2/M2 connected vehicle corridor. It will help us test some of those services, Day-1 services for us, because it brings us up to speed with what's been happening across Europe."*

Rijkswaterstaat

## Results

- Successful operating and testing of the services within a lot of complex scenarios and during live road works
- Validation of interoperability between roadside and many and diverse international On Board Unit and Human Interface implementations
- Identification of remaining gaps to be closed in the common specifications for ITS-G5
- Collection of valuable data sets for further analysis and evaluation
- Strengthening of international public-private cooperation
- Establishment of solid foundations for the next three InterCor TESTFESTs to develop upon
- Gaining valuable input for the C-Roads specifications by validating the InterCor common specifications

*Participant ALPS Electric Europe GMBH, Czech Republic*

*"We have been preparing for 2 or 3 months for the TESTFEST because we were working on some applications we want to try here, during this event."*

## The future is now

The TESTFEST showed that the development of the ITS-G5 technologies has reached the next stage. Not only because the tested services operated correctly, but also because it prompted a lot of interest from major automotive and software companies. And the presence of many international suppliers to the automotive industry is further evidence of this new found interest. The technology is clearly maturing, and by working together public and private parties are on track to achieve a harmonized, large scale roll-out of ITS-G5 services across Europe in 2019.

Rijkswaterstaat

*Participant Aricent Technologies Limited, Germany and USA*

*"We still experience a couple of artefacts during the TESTFEST. But this is the reason why we are doing these TESTFESTs, to see that the interpretation of the messages which are sent by the system does match the expectation by the road operators and is also helping the drivers in the way it's expected, finally. But I think technically the system is maturing now, the scenarios being tested are really getting complex and leading to nice interpretation. That really also helps maturing the own system and seeing that the complexity can be handled correctly by the system."*

# 2.2 Results phase 2

## Technical outcome

The project intensively tested the concept of the cooperative services step-by-step during the four pre-deployments and the InterCor TESTFEST. The description of the technical outcome of these field tests is based on four sub-objectives, which form the first part of the project team's assignment.

***Develop specifications: in cooperation with the market, develop specifications that enable realization of a future-proof platform for further development of ITS services.***
In cooperation with market parties, the project has developed four technical specifications for cooperative services based on the communication technology WiFi-P:

1. C-ITS Central Unit Requirements specification
2. Dutch ITS Corridor Road Side Unit – Central Unit interface specification
3. Road Side Unit Placement Guidelines
4. Description of the System Concept

The project shared new design documents with interested market parties during a second C-ITS Corridor market day in July 2016. In addition, the specifications for the Central Unit and the Road Side Unit Replacement Guidelines were discussed in the Dutch round table for Architecture & Interoperability.

## Selected key Lessons Learned

- The definition and interpretation of the in the DENM and IVI messages required traces and zones respectively is complex and multi-interpretable. This technology is tried-and-tested and has proven to be useable during pre-deployments and TESTFEST. However, further developoment is necessary.
- The exact event position, required for the functioning of the service, is not available in the right quality at the moment.
- Describing, recording and formalizing specifications of learning experiences gained during field tests with (international) partners turns out to be extensive and complex. This needs more attention in the follow-up phase.

***Maintain compatibility: develop and maintain international cross-border compatibility.***

The international cross-border compatibility has been safeguarded for cooperative services on the Rotterdam-Frankfurt-Vienna corridor, for motorways with variable message displays as well as from lane closure trailers. Agreement about the further specification of standards was reached with Germany and Austria. The agreement was documented in the following profile documents:

1. Cooperative ITS Corridor; roadside ITS-G5 profile v1.0 (24 October 2016)
2. Dutch C-ITS Corridor profile v2.1 (28 October 2016)

Furthermore, within the scope of the TESTFEST, agreement was (largely) also reached with Belgium, France and the United Kingdom. The agreement and remarks were documented in the profile document 'Dutch C-ITS Corridor profile v3.0' (12 May 2017), which was published as a C-roads profile by the C-roads platform.

Rijkswaterstaat

Agreement has been reached with Germany and Austria to work on further harmonization of the specifications for cooperative services with involvement of France. This is to result in publication of a next release of actual harmonized services for cooperative services by C-roads.

## Selected key Lessons Learned

- The standards are mature in a way that interoperability within the standard is possible. The profiles, i.e. higher-level agreements with regard to the use of the standards, yet leave many choices and combinations open. Further international harmonization of profiles is therefore necessary.
- Because of continued development and extensive harmonization in the specifications cross-border testing remains necessary. Association with an international platform for the exchange of results is crucial.
- Testing of On Board Units against Road Side in combination with the Central Unit of the same supplier generates practical insights. In order to gain sufficient insight in comptability and to open up interfaces it is necessary to work with interchangeable systems of different suppliers for Central Unit, Road Side Unit and On Board Unit in the next phase.

*Validate concept: validate the concept of the three cooperative services.*

The cooperative services on a motorway with variable message displays as well as from lane closure trailers have partly been sufficiently validated for deployment. The outcomes of pre-deployment 1 and 4 show that the new communication technology WiFi-P works in terms of technology. During the TESTFEST, the first message was displayed well earlier than at the minimal required distance of 700 metres. However, for further introduction the cooperative services need to be fully automated and tested over an extended period.

For the service Sensor data from vehicles (PVD), to the extent that this service was tested in pre-deployment 2, equipment from third parties can indeed be used.

In general, there are remaining uncertainties with regard to acceptance of the functionality by the road user and traffic safety. It is therefore essential to perform tests with typical road users and evaluate user appreciation as well.

## Selected key Lessons Learned

- Testing during live operations on the road stimulates understanding and accelerates the learning curve.
- Validating the concept is not possible without On Board Units with HMI implementation in the first place. That is why we need to seek collaboration with OEM and suppliers.
- A lot of knowledge was gained by validating the concept through the use of test pilots during field tests. However, in order to gain insight into the user experience – and thus into behavioral effects on the road – it is crucial to also test with the typical road user during the project. This demands a prolonged and extensive user evaluation as part of the rollout preparations in the next phase.

*Resolve uncertainties: obtain certainty with regard to standards and the application of privacy and security.*

The learning question whether the impact of privacy, security and sensor data from vehicles is known and solvable can partly be answered positively at this stage. The uncertainties with regard to privacy and security were reduced, but not completely resolved. In addition, in cooperation with the DITCM programme an application for the Dutch Data Protection Authority was prepared. Privacy is mainly a subject for the cooperative service Sensor data from vehicles (PVD). It is therefore necessary to continue discussing and exploring this subject on a national level in the Dutch round table for Legal Aspects and on a European level with the countries cooperating in the ITS Corridor project together with the InterCor project.


## Selected key Lessons Learned

- For a long time, there has been a lot of insecurity about the approach to be followed with respect to Public Key Infrastructure (PKI), also as a result of international developments within the European C-ITS platform. Join (now) existing PKI initiatives from the Dutch government.
- Verification of a Probe Vehicle Data use case against the Personal Data Protection Act is only useful if a clear defined use case is available.
- Make manageable but concrete steps with PKI implementation. Participate in every test and/or validation event.

## Expertise accumulated

The description of the expertise accumulated by the C-ITS project is based on three more sub-ojbectives. In general, building knowledge and, in particular, insight in costs of deployment of the cooperative services on the Dutch part of the corridor and impact on the organization and traffic management processes.

***Knowledge building: learn and accumulate and maintain knowledge for the Rijkswaterstaat organization and other relevant organizations such as road operators and private parties.***

We have learned a great deal in phase 2. A lot of effort has gone into accumulating, maintaining and sharing knowledge. Much of the knowledge was gained through practical experience and shared internally as well as externally, for example:

- Publication of factsheets, film clips and news articles
- Publication of technical documents
- Attendance of Rijkswaterstaat and Connecting Mobility colleagues at demo test events

The C-ITS project involved a lot of Rijkswaterstaat colleagues from different departments in e.g. preparing national and international specifications, refining the customer demands for the Day-1 services, preparing reports on Road Side and On Board Units, writing test scenarios with market parties and working on On Board Unit developments with market parties. Thus, the Rijkswaterstaat organization gained a great amount of specialized knowledge.

In addition a technical evaluation, a process evaluation and an overview of the lessons learned in phase 2 were completed.

### Selected key Lessons Learned

- In a very short period of time, the TESTFEST resulted in the introduction of an internationally aligned profile in C-roads. Mix analyses/specification of production with real life experiments as often as possible. This leads to accelleration.
- Define clear research questions in advance and structure your evaluation accordingly. Make the evaluation your focal point.
- Be brave enough to pinpoint prominent milestones early and make them leading. Also and especially for communication purposes. Choose those milestones in a way that they become the heartbeat of the project. That way we create focus and energy.

***Insight into costs: a solid insight into costs and risks of deployment on the Corridor and of nationwide rollout.***

The possible road operator costs for cooperative services on a motorway with variable message displays as well as from lane closure trailers are not yet sufficiently clear for deployment. The C-ITS project developed a financial model, in which rollout scenarios have been worked out based on technical variants for fixed Road Side Units and/or lane closure trailers. This model will help the project team in preparing a tendering phase. Due to the innovative character of the Cooperative ITS Corridor it is and will be necessary to work with a limited number of assumptions. The cost model will be improved in the next project phase. Last but not least: experience teaches us that the costs of new technologies are expected to decrease.

## Selected key Lessons Learned

- The playing field is rapidly changing. On Board Unit development and introduction of cooperative services are being driven by the automotive and its software suppliers.
- Flexibility in procurement and contracts is essential in order to to make steps.
- At this moment, there is no mature market for OBU/HMI solutions.


Rijkswaterstaat

***Impact on processes: determine the impact of RWW, PVD and CRW on the Rijkswaterstaat primary processes and organization.***

Insight into the impact of RWW, PVD and CRW on the Rijkswaterstaat organization and processes for traffic management and management and maintenance has not yet been obtained.

## Selected key Lessons Learned

- The subject proved to be more problematic than initially expected, in The Netherlands as well as in Germany. In order to be able to comment specifically on the impact on the processes the technical system needs to be sufficiently developed.
- Cooperative services will cause a shift between private and public tasks and will therefore impact the organization of market and administration.

## Complementary activities

As in phase 1, the C-ITS Corridor project also engaged in a number of complementary activities in this phase of the project. A second market day was held in July 2016, with a recap of the RWW field tests and interactive workshops. The project was also present at a number of national and international exibitions and events such as Intertraffic, Innovation Expo, Infratech and the Connecting Europe Conference.

# 3 C-ITS Corridor next steps

In the past phase of the C-ITS Corridor project major steps were taken in an international context to offer the road user cooperative services in the foreseeable future.

*Serge van Dam: Strategic advisor Smart Mobility, Rijkswaterstaat*

*"The C-ITS Corridor project has been a great journey of learning and developing, together with Austria, Germany and private enterprise. As our minister has explicitly stated and has recently been confirmed in the new coalition agreement, the Netherlands wants to remain at the forefront of Smart Mobility. The next phase of the C-ITS Corridor can help us achieve just that and move towards deployment."*

The pre-deployments and international tests performed by the Dutch project team have also demonstrated that necessary work remains to be done before we can actually start introducing cooperative services. It became obvious that the (automotive) industry is in the lead right now, with investments, 'technology push' and commitment for large scale introduction of vehicles equipped with cooperative communication as early as mid-2019. This creates momentum to also accelerate the commitment of the public sector.

That is why the C-ITS Corridor project is getting ready for the final preparatory phase, 'Rollout Preparation'. The existing smart cooperation with the Rijkswaterstaat EU project InterCor will be intensified. Partly thanks to this unique international embedding essential learning questions, which have not been answered conclusively yet, will be given a place in the 'Rollout Preparation'. For example, questions with regard to privacy and security, scalability and changing processes in the operational organization. The pre-deployments have proven that seemingly trivial technical details can sometimes have a major impact on parties in the chain, including Rijkswaterstaat.

During the 'Rollout Preparation' our efforts will be targeted on enhancing the cooperation with new partners and market parties by further connecting with national initiatives like Talking Traffic. Our essential Corridor partner Germany has already started the rollout for the entire country and Austria is also making concrete steps in that direction. It is time for The Netherlands to also make these new Smart Mobility services a reality.

The urgency to make the next step is undisputed and tangible. "The Future is now". Together we will use this unique momentum to make proper strategic choices. That way, the C-ITS Corridor project will make a concrete contribution to the leading Dutch position in Smart Mobility.

*Kai Feldkamp, Programme Director Smart Mobility, Rijkswaterstaat*

*"For us, Smart Mobility is a development where ICT, traffic management and the civil engineering industry work together to provide innovative solutions."*


Fast Ferry
Ring Rotterdam(zuid)
Europoort
Ridderkerk
Gorinchem
Dordrecht
Breda
via A15
LK53
DAF


Cooperative
ITS Corridor
Joint deployment


Published by

**Rijkswaterstaat**

For further information visit
www.its-corridor.nl

november 2017 | PPO1117ZB011